A WINDOW OPEN ON THE WORLD

The UNESCO Courier

MARCH 1962 (15TH YEAR) - PRICE : 1/-STG. (U.K.) - 30 CENTS (U.S.) - 0.70 NF (FRANCE)

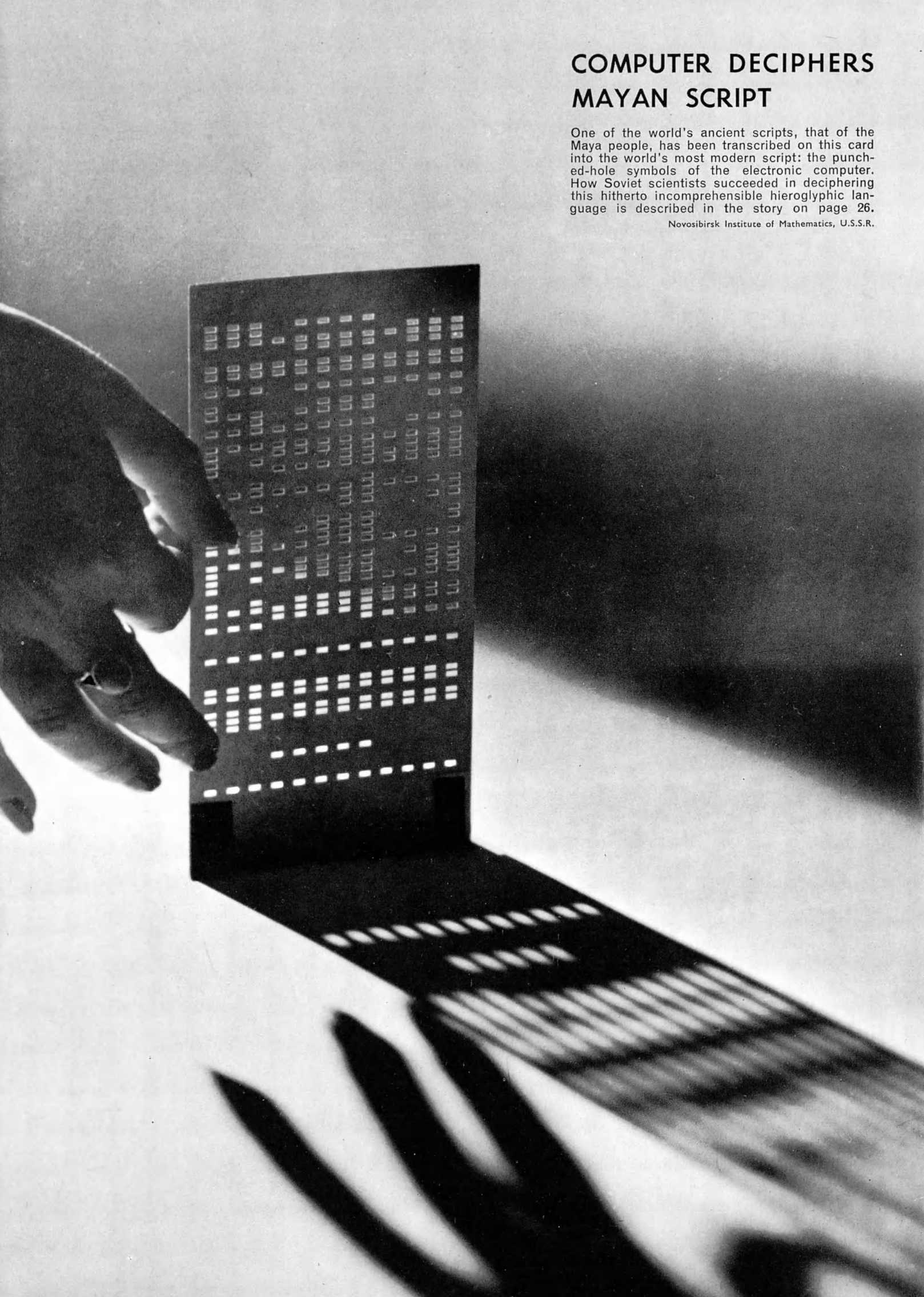
THE AWAKENING AFRICAN CINEMA

UNESCO ARCHIVES

COMPUTER DECIPHERS MAYAN SCRIPT

One of the world's ancient scripts, that of the Maya people, has been transcribed on this card into the world's most modern script: the punched-hole symbols of the electronic computer. How Soviet scientists succeeded in deciphering this hitherto incomprehensible hieroglyphic language is described in the story on page 26.

Novosibirsk Institute of Mathematics, U.S.S.R.



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COVER PHOTO

This boy is a Bororo Peuhl, a pastoral nomad people of Africa. He watches over large herds of cattle and one day will lead a herd in search of fresh pastures and water. When he does and returns home he will be considered a man and can marry the girl of his choice. A beautiful documentary has been made on the Peuhls (see page 13).

From "Nomades du Soleil" by Henry Brandt published jointly by © Editions Clairefontaine and Guilde du Livre, Lausanne.

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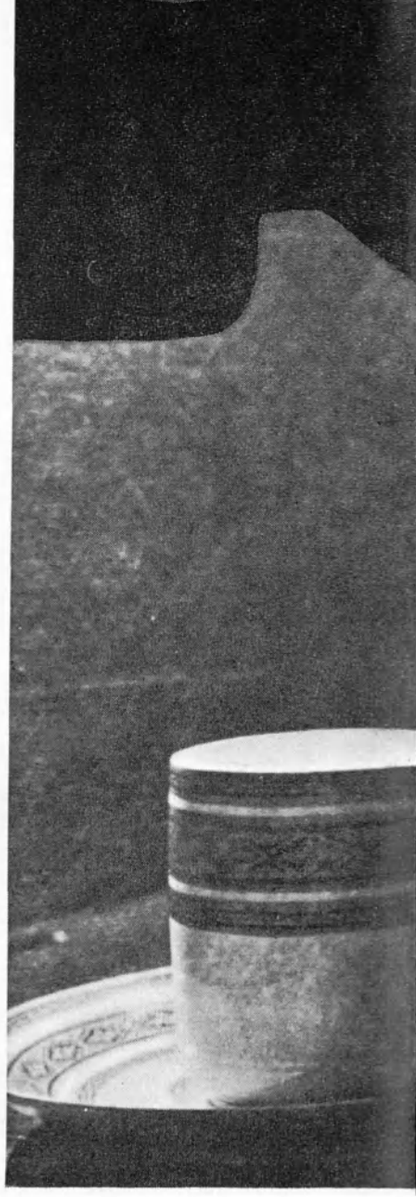
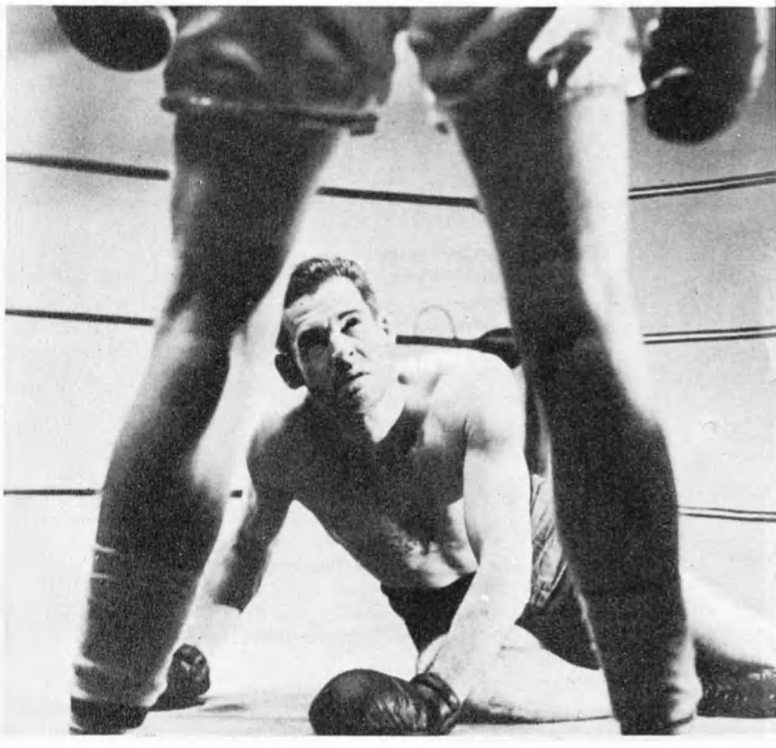
THE ART OF SEEING A FILM

by J.M.L. Peters



For persons of all ages but perhaps more so for the young, the best protection against the faults and excesses of films and television is the awakening, development and proper training of the critical faculties. This is not criticism for its own sake but so people can be more selective in the films they see and also understand them better. Film teaching is already common practice in the schools of a number of countries. The Unesco Courier strongly recommends "Teaching About the Film " by J.M.L. Peters, a book just published by Unesco, the Introduction of which is reproduced below.

MORE TO IT THAN MEETS THE EYE. The meaning of a film picture is usually not identical with the object or situation represented by it. The scene below from Robert Wise's "The Set-Up" does not merely represent a boxer who has just knocked out another. It "says" something "The winner domi-



THESE days many educational authorities, as well as parents, seem to have it on their consciences that they ought to "do something about the film." They often appear to envisage some form of intervention, or interference, from the sphere of education into that of the cinema.

The arguments in favour of such action stem mainly from the conviction of many adults, including many educators, that motion pictures are a danger to young people. Their view is that even though most films do not overtly express ideas and opinions which might be considered morally bad, and even though sympathy is not actually expressed for gangsters and other villains, nevertheless the cinema may form a bad emotional environment or intellectual climate for the young and immature.

Certainly the world shown by many films is not a true reflection of reality. It is often a world where, for example, family life, work, culture and religion appear supremely unimportant. Rarely is family life depicted as being important in itself; it offers only a framework for the actions of the principal characters on the screen.

Similarly, many films give the impression that work is an unimportant part of man's life. Only very seldom is the relation of the film hero or heroine towards their jobs of any importance for the development of the film story. As for cultural values, it can surely be said without offending anybody that art, science, technical and social progress are not the main concerns of many film makers nor of the persons who play a leading part in their films.

Thus it is no exaggeration to say that many films are

K. van der Groep

nates the whole situation, the loser's defeat is absolute." In this picture from "Notorious", Alfred Hitchcock has used lighting and perspective to create a dramatic relationship between the girl and the cups of coffee and the shadow of the hand in foreground gives a threatening effect to the whole.

likely to induce the inexperienced and uncritical onlooker to believe that life is made up largely of crime and sex. The actions of the leading characters are often motivated by the desire for social success, wealth, prestige or authority.

Sex and romance, crime and adventure, swashbuckling heroics and personal achievement are the predominant themes of a great many films. The sentimental element is over-emphasized at the expense of reasonable argument. Problems are solved in a way designed to satisfy the onlooker's emotional wishes rather than the claims of his intellect.

Physical advantages—strength or beauty—are generally presented as more desirable than brains or character. The social situation of man (and woman) as depicted by the movies also differs considerably from reality. The heroes of the screen generally have "romantic" professions or jobs; they may be cowboys, dancers, singers, actors, sporting champions, detectives, officers in the armed forces. But the office stool is not valued very highly. Indeed, a large percentage of the characters on the screen are already apparently so rich that they do not need to work at all.

Similarly, the surroundings most frequently shown in films are the prairie, the theatre (behind the scenes as well as from the stage), the racecourse and boxing ring, the luxury flat, the night-club frequented by gangsters, the glamorous outpost of empire—not the wash-tub, the factory or the poor apartment.

Yet since (it is argued) one cannot prevent or counteract these "hidden dangers" solely by means of negative measures, such as film censorship, one has to do something positive. However, what is meant here by "positive" has often in the past turned out to be still rather "negative"; young people, it has been said, ought to be put through a process of being "disillusioned" about their film experiences.

As early as 1933 the American Professor Herbert Blumer wrote that one ought to teach young cinema-goers not to involve themselves too deeply in the action of a film or in the problems of its heroes, in order not to lose their critical detachment towards the film itself.

Young people, he thought, had to learn to develop what he called "adult discount"—that is, they should cultivate aloofness—in order to remain consciously the spectators and to avoid becoming sympathetic participants.

I myself think that nowadays we see more clearly that one may develop a critical attitude towards the cinema without at the same time becoming so detached that a film experience in which one participates as a deeply-engrossed spectator is forfeited.

As was remarked by Professor Edgar Dale twenty years after his compatriot Blumer: pedagogically speaking it would be no small loss, and seeing a film would be a less rich experience, if one were to cultivate such an emotional detachment among young people.

What Lord Radcliffe wrote in *The Problem of Power* is worth recalling at this point: "The spread of education has given most people the apparatus of criticism; what it has not always given them is the knowledge of how to use their machine for an end that is not merely trivial or destructive. Yet criticism is essentially a method of

CONT'D ON NEXT PAGE

MAGIC OF LIGHT

Basically each film picture owes its power of expression to a combined use of visual and sound effects. Among these, lighting has an important role. This is illustrated by two shots from "Variations on a Film Theme" in which the same face, under different lighting conditions, has its expression completely transformed.

ART OF SEEING A FILM *(Cont'd)*

Don't be bluffed by glitter & glamour

appreciation. It has no necessary connexion with the awful luxuries of contempt or condemnation."

Therefore, the cultivation of a critical attitude means, in a sense, "self-immunizing". The spectators must not be bluffed by the glitter of a picture and its stars, nor by the refined techniques of film production. In this respect the advice that "one ought to learn to withdraw from the suggestive power of the film" can have real meaning.

It really comes down to this: where a worthwhile film is concerned, the film experience of the young spectator should certainly be allowed to be deep; the depth of his impressions, however, should not primarily be due to the glamour of the stars, the fabulous production costs, or technical novelties and trickery.

To offer a protection against this type of spurious appeal is a negative postulate of film education: the need for critical evaluation and assimilation is a positive demand.

In American literature on the subject, film education is mostly referred to as "motion picture discrimination", and in that term I think both the above meanings (of withdrawing from the suggestive power of the film, and of critical evaluation and assimilation) are present. However, in the so-called Wheare Report of 1950 (1)—which could be regarded as the English charter of film-teaching—the dangers of the film and the necessity of arming young people against those dangers were given priority.

The view that the film may be also a new form of art in its own right has been late in coming to the forefront of pedagogical studies and of film educational practice in most countries. It is remarkable that, generally speaking, the teaching of appreciation of the film as art must still be first defended with the argument that the best way to protect young people against the moral dangers of the cinema is to cultivate their film aesthetic taste.

YET changes have been coming over this scene. Whereas in England the view was held for many years that film education had to be art education in the first place, many members of the Society for Education in Film and Television (formerly called the Society of Film Teachers) have, for instance, for a long time past been concerning themselves with aspects of the film other than its aesthetic ones, that is, with social, ethical and cultural values.

What has happened in England has also happened in other countries where film education has become an accepted notion, and in other circles besides those professionally interested in the subject. But let us not be carried away: right up to the present there has remained a strong and active body of opinion upholding the opposing viewpoint that film education can have nothing to do with social or moral values.

Sometimes one even hears the opinion expressed that a discussion about moral or social problems inspired by a feature film does not rightly belong to the domain of film-teaching but to the sphere of the teaching film (that is, visual aids). Here lies a common misunderstanding.

There are, of course, points of contact between film education and the use of film as a visual aid in teaching, but a very essential difference is that in film education one always comes back to the *film;* the film, however, regarded not merely as an aesthetic object, but also as a social institution, as a means of mass entertainment having special effects and influences on the cultural and spiritual level of the people, a medium for communication of ethical, religious, and other spiritual values.

As things stand, the film only very seldom qualifies as being wholly a form of art. Most often it is something like the newspaper, or a form of public amusement such as a fair or a sports meeting.

OF course, one may take the view that one cannot be bothered with this type of film—thereby excluding from one's interest the major part of film production. This may be a legitimate attitude for the private individual, but in my opinion it is not a valid one for the educator to adopt. For the latter cannot get away from the fact that many non-aesthetic or extra-aesthetic elements in the film represent an important part of the normal world in which young people live.

This has nothing to do with the use of films as teaching aids; it simply means that one ought to teach young people how to integrate the experiences they have acquired from a film into their own lives.

To the average member of the average cinema audience, the film seems to have a similar function to the novel or the stage play. All these "media" offer him an opportunity to participate in another life, the life of other people, in other surroundings and circumstances, in other regions of the world.

The cinema screen, the covers of a book, the theatre curtain are alike the doorsteps to a second world, where he can lead a second life—perhaps in some respects a "double life". But the reading of a book can be compared only to leading a second inner life, because the world described in words is an inner world, which we can perceive with our spiritual eye only.

But the film not only represents reality almost true to nature but also places the spectator emotionally right in the centre of the life that is going on within this reality. Let us examine this phenomenon a little more deeply, by citing an illustration which may seem a trifle homely but which is nevertheless very much to the point.

One day when we were still at school, the physics teacher entered our classroom. He put a mirror on the demonstration table and placed a burning candle before the mirror. And then we made a "scientific" discovery about something which we had probably seen a hundred times already: we found out "scientifically" that the candle we were seeing *in* the mirror and the candle *before* the mirror were identical.

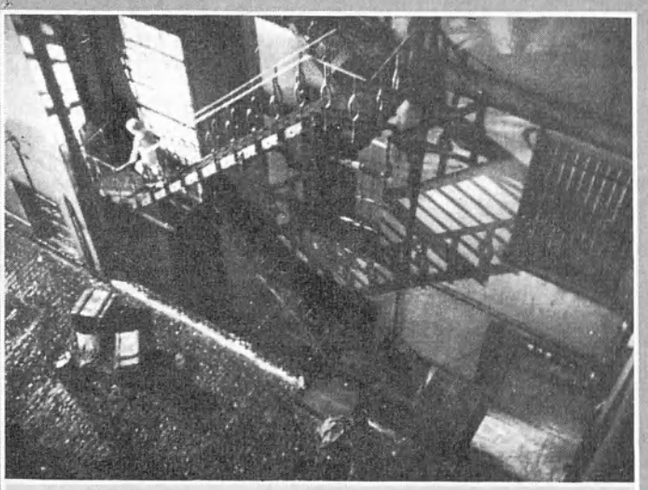
We also heard the scientific term for this: the candle before the mirror was called in physics a *real* object, the one in the mirror was a *virtual* object. For the rest,

CONT'D ON PAGE 8

(1) *Home Office, "Report of the Departmental Committee on Children and the Cinema", London, H.M.S.O., May* 1950.

VISUAL LANGUAGE

Each separate picture in a film can be given special meaning depending on how the spectator stands, so to speak, both mentally and spatially, in relation to what he sees on the screen. This "positioning" is done by the camera (distance, height, angle, position and movement all play their part). It can be objective (the spectator is a mere observer), or subjective (he identifies himself with a person or persons on the screen) ; or intermediate between these two. The sequences below from Carol Reed's film "The Fallen Idol" show the three techniques. (1) We look with the boy through a window and see a couple quarrelling (intermediate objective-subjective). (2) A "reverse-angle" shot. We see the boy face-to-face (objective). (3) We witness the quarrel as though we are looking on through the eyes of the boy (complete identification-subjective).



RHYTHM IN A FILM

Various elements of motion may be present in each picture—the objects in the shot may be moving, the camera may have been in motion when shooting, or the composition of the picture itself may arouse a sense of "subjective motion" in the spectator. The object is to combine the objective and subjective motions of the separate shots into a rhythmic whole. Above, three successive shots from Carol Reed's "Fallen Idol" illustrating these techniques. The child sees a woman fall downstairs (objective close-up). Seeing the man run downstairs he draws back hurriedly from the window (movement of the object being filmed). Terrified, he runs down the fire-escape (camera changes position and looks down from above.) This linking up of brief contrasting images resolves itself in the spectator's mind into a clear and complete picture of what has taken place.

From the other side of the mirror

there was almost no difference between the two candles, except for this major one—we could touch the real candle, the virtual one we couldn't.

This school experience has been recalled to make clear what is meant when we say that the film confronts us with reality in a "virtual" way. When we are truly fascinated by a film it seems indeed to reproduce reality more or less true to nature, apart from the fact that we cannot touch this reality; that is to say, we cannot experience it physiologically.

There are still other similarities between the experience of looking in a mirror and seeing a film. When we look into a mirror, we find ourselves physically in a room in which the mirror in question hangs on the wall. Yet at the same time we are in some way—"virtually" again—present in the room on the other side of the glass, in the room that is reflected by the mirror. The furniture and other objects in the real room, we see *from* the reflected room. In a sense, we have stepped over into the room of the mirror and from there we perceive our environment.

In much the same way, like Alice through the Looking Glass, we experience the people and things on the cinema screen from the space (it may be a street, the interior of an aeroplane, or a living-room) in which they happen at that moment to be situated. If, when a film is being made, a certain scene is shot *in* a living-room, where some people are talking with each other, then the spectator sees this scene from the same point of view as the camera saw it from when shooting the scene.

And if the same scene is taken from several angles, the spectator will see the scene successively from those different angles. Though he is, physically, sitting down in his chair in the cinema, he finds himself at the same time *virtually* in the room where the film actors are, and indeed moving about in it. He sees the action on the screen from time to time through the eyes of the actors.

Thus there is a kind of two-way traffic between the spectator and the film, and as a result we are often strongly involved in the events of the film, even though we still remain mere "onlookers". For, of course, we have to limit our activity to mere looking and we cannot intervene in any real sense in what is happening on the screen.

And here we come across another facet of this phenomenon. Again, a homely illustration: If we are eyewitnesses of a car accident, our activity will probably not be restricted merely to looking but, will take some form of practical action.

Seeing a similar accident, just as serious, depicted on the cinema screen, we omit all such action, however strongly we are emotionally affected by this scene. (And we may be very strongly affected, because the film maker will possibly have shown us the scene through the eyes of the driver or of the victims.)

Now in such a case, where there is no escape valve for our inner urge for what can be called motor activity, this activity turns inwards and our emotional reactions become all the stronger.

Such emotional participation consists mainly of two mutually connected processes which are, of course, usually called "projection" and "identification". In this phenomenon, on the one hand, the spectator, attaches his own tendencies, feelings and character traits to the actors on the screen—he "projects" them into the actors—and, on the other hand, the spectator thinks himself into the spirit of an actor and his role to such an extent that he identifies himself with him and feels and thinks like him.

On the one hand the spectator loses himself mentally in the screen; on the other, he incorporates the world of the film into his own person. And again we can apply the term "virtual" to these processes, for there is no real contact with the people on the screen and there is no such relationship between the spectator and these people as there would be in reality—because the "glass of the mirror" stands between them.

The conclusion to be drawn from this exposition is that seeing a film can be a "virtual physical" and a "virtual mental" participation in the life of other people in ano-

HOW TO ANALYSE A FILM

Environment and action

1. Where does the action occur?
2. Is the scenery familiar or exotic?
3. Is the locale treated fully, superficially?
4. Is description realistic and of general interest?
5. Why does it interest you?
6. What are the chief situations?
7. Is an "exciting pursuit" a sensational feature or an essential element of the action?
8. What is the chief theme; what are secondary ones?
9. What is the genuine relative importance of these themes?
10. How does the action develop?

The characters

11. What kind of people are the main characters?
12. Why do you find them attractive or displeasing?
13. Are appearance or character stressed most?
14. How much do these influence the action?
15. Are the professions of the characters fairly represented?
16. Does an attractive or displeasing character come out as "winner" or "loser"?
17. Is the character of the main roles "genuine"?
18. Which professions are depicted favourably?
19. Are main characters' occupations presented more favourably than in real life?
20. How do the main characters behave?
21. Should we approve or reject their behaviour?
22. Does it deviate from social or moral standards? Is it nevertheless justifiable?
23. What are the main characters' motives—egotism, altruism, idealism, love, self-sacrifice, desire for money, success, authority?
24. How do these motivations become apparent?

Ideas in the film

25. Does the film have an obvious or hidden tendency?
26. Does it make propaganda for any belief or cause?
27. What moral does it make?
28. Can we agree with these views?
29. What ideas are advanced about cultural, social, other standards and concepts?
30. Does the film use proper arguments to defend or reject certain views?

Scene from *The World, the Flesh and the Devil,* made by Roland MacDougall. In general the aim of all film-makers is to carry the spectator into another world. We must therefore know how to "liberate" ourselves from the suggestive effects of a film and its emotional impact. Only thus can we analyse lucidly the action and the behaviour and ideas of the characters and benefit fully from films we see.

ther world. Or, to put it another way, to see a film is to lead a second (virtual) life in a second (virtual) world.

For some persons this experience can be as real as normal daily life, apart from its "virtuality", so to speak. However, from this very virtuality it derives its own charm, its appeal, its magic. We cannot "touch" it, but neither can it "touch" us: it happens to us and we go through it, but without any risk.

It is impossible as yet to state in detail, or even to foresee completely, what will be the educational consequences of regular and repeated excursions into this so-called "second world". But one thing is certain: a new pedagogical situation has been created.

The situation in which youth is now growing up is completely different from that of fifty years ago, as a result of the fact that young people are, as we have said, living in two worlds. They are not subjected to the geographical, social and cultural isolation which was the rule for former generations.

Much earlier than before, in a much more direct and far-reaching manner, the young people of today are confronted with views, traditions and standards different from those of their home environment. And they are also confronted with what can only be described as a new "language".

Some educationists—for instance, professor Louis Stückrath in the Federal Republic of Germany—have stressed the point that film, before being a work of art (or a medium for entertainment, a visual newspaper, and so on) is a new *language*, a new means of understanding and, along with that, a new means of gaining knowledge.

In our culture, which until recently was mainly a book-and-word culture, our mental life and the all-important process of communication between human beings have been primarily a matter of discursive thinking and reasoning. Whatever is to be communicated to us by other people by means of books and words, or whatever we ourselves want to communicate to others, has to be analyzed, so to speak, in a logical-rational way; it has to be broken down and placed within the grammatical categories of the sentence-construction.

But with the development of *film language* as a new species of the general genus "language", a non-discursive means of communication has been put at our disposal. This not only presents us with new laws of thinking and reasoning but also leads our minds to other ways of acquiring knowledge.

The film language opens up to our minds a new dimension; perhaps a dimension that, in different respects, meets the needs of modern life better than verbal language alone is able to do. If this is indeed so, then the incorporation of this new language into our film educational activities should not be merely supplementary, but the most fundamental thing of all.

Thus it quickly becomes clear why of recent years in almost every textbook for the teaching of English in the United States of America there is a chapter on the film. In that country, perhaps intuitively, they have realized that language-teaching can no longer be limited to verbal language alone, but has to be expanded to cover teaching about communications in general, and that film-teaching should not be just a part of general art education and social and moral education but also a part of the teaching of general communication theory.

From this point, it is only a short step to recognition of the fact that film education is itself just a part of an educational process related to all the mass media of communication and especially to the mass medium which is most closely associated with film, namely, television.

This again presents new tasks for educators, of which not the least important is the need to teach young people that there are other means besides film and television for passing leisure time in a useful and agreable way.

JAN M. L. PETERS is director of the Netherlands Film Institute and Film Academy. He was formerly director of the Netherlands School Film Services and secretary of the Institute of Film and Youth.

Today a new African cinema is coming into being, which is adding something new and significant to the cultural and artistic life of this continent. The importance of this development was underlined at an international round-table discussion held last year in Venice on " Africa and Contemporary Civilization ". At this gathering Unesco presented several studies on the cinema in Africa. The article below is an edited and abridged version of a study by Jean Rouch, in which the French film producer traces the development of the cinema in Africa and looks at some of its new trends. This subject will also be dealt with in future issues.

Cinémathèque Française, Paris

ACCENT ON THE EXOTIC. For many years, films on Africa showed little more than the exotic side of the so-called Dark Continent. It is only recently that film producers have begun to look at the more human side of Africa. Above, a scene from *Trader Horn* (1931). Below, Donald Swanson's *Magic Garden* (1950), a minor musical masterpiece telling of the amazing adventures of a Negro youth in Johannesburg.

Cahiers du Cinéma, Paris

THE cinema made its debut in Africa in the very first years after its invention. A vaudeville magician managed to steal one of the first "theatregraph" projectors from the Alhambra Palace theatre in London in 1896 and used it to introduce motion pictures into South Africa. It is interesting to note that South Africa still employs the turn-of-the-century word "Bioscope" to describe a cinema theatre.

In West Africa the first motion picture projections go back to 1905 when mobile cinemas began showing animated cartoons in Dakar and in surrounding villages. It was also during this period that explorers first began to use motion picture cameras in the course of their travels. The French Film Library (Cinémathèque Française) in Paris possesses several catalogues by Georges Meliès which make mention of the first films made in Africa.

Since this early pioneering period the cinema has witnessed quite an extensive development in Africa. Tropical Africa, however, has remained one of the most under-developed regions as far as film showings are concerned, and the world's most retarded continent in the field of film production.

While Asia and South America have been making films for years (in fact Japan, India and Hong Kong are now the world's three leading feature film producers, ahead of the U.S.A. which has dropped to fourth place), tropical Africa has as yet to turn out its first full-length feature picture. As the French film historian Georges Sadoul recently wrote: "Sixty-five years after the invention of the cinema, not one truly African feature-length film has been produced to my knowledge. By that I mean a film acted, photographed, written, conceived and edited by Africans and filmed in an African language."

Now, at a time when a true African cinema is about to be born, I think it is worthwhile to take stock of what has been done, what is now being done in Africa and to examine the new trends of African cinema.

The first films shot in Africa were frankly "exotic." They showed the strangeness of the continent, viewed as a land of "savages" and "cannibals." The African was portrayed as a wild creature whose behaviour was intended to provoke laughter when it did not border on the pathological. With the end of the first World War came the stereotype of the childish, good-natured native.

The first noteworthy film about tropical Africa was probably *Croisière Noire* (Negro Cruise), made by the Frenchman Léon Poirier during the first motor-car trip across Africa from north to south in 1924-25.

The basic theme of the film was the epic automobile adventure, but parallel with that it showed the most representative aspects of the people encountered en route. Though the team was pressed by time the film men proved their ability both in choosing and seeing their subjects. The scenes they shot are now dated but nevertheless remain priceless documents on Africa and the history of its cultures.

THE AWAKENING AFRICAN CINEMA

by Jean Rouch

There can be no doubt about the sincerity and good intentions of the authors of this film. And yet two facts stand out sharply today. The unit simply did not understand the world they were filming and which they glimpsed only scantily. Second, even when they had more time on their hands during long halts, their approach was that of the "let-us-look-at-the savages" type with scenes of platter-lipped women, details of certain circumcision rites, or aspects in the life of pygmies.

Although photographed with a maximum of objectivity the scenes remained cold, if not ironical. They had none of the human warmth which we find in the earlier or contemporary films made by Robert Flaherty such as *Nanook of the North* or *Moana.*

The same can be said of most of the exotic films of the time when Western cameras were discovering the rest of the world with Marco Polo-type lenses, or just about. The situation worsened in later years when we find the camera portraying Africa as a continent of barbarism and cruelty, although it must be admitted that Africa was not the only region to undergo such treatment. Asia, South America, Greenland were brought to the screen with paltry sequences of savage dances, guitar strummers and primitive hunters.

But this period also gave us *Trader Horn* which created a sensation by showing an African devoured alive by a crocodile (it was never learned whether the scene was faked or an accident) and especially *Sanders of the River* starring Paul Robeson. *Sanders of the River* was one of the first good talking pictures to be made on Africa and was quite a success in tropical Africa.

The late 1920s also saw the appearance of the first true documentary films about Africa. André Gide had gone to the Congo in 1926 and had taken with him Marc Allegret who returned to France with *Voyage au Congo* (1928). In 1938 the African specialist Marcel Griaule produced two anthropological films in the heart of the continent, using sound track with 35 millimetres. *Au Pays Dogon* (In the Land of the Dogons) showed the daily life and religion of the Dogons. More important was *Sous les masques noirs* (Under the Negro Masks) a film relating the funeral rites and customs of a Bandiagara cliff village in what is today the Republic of Sudan.

Two years before, Jean d'Esme had filmed *La Grande Caravane* in eastern Nigeria which told the story of a

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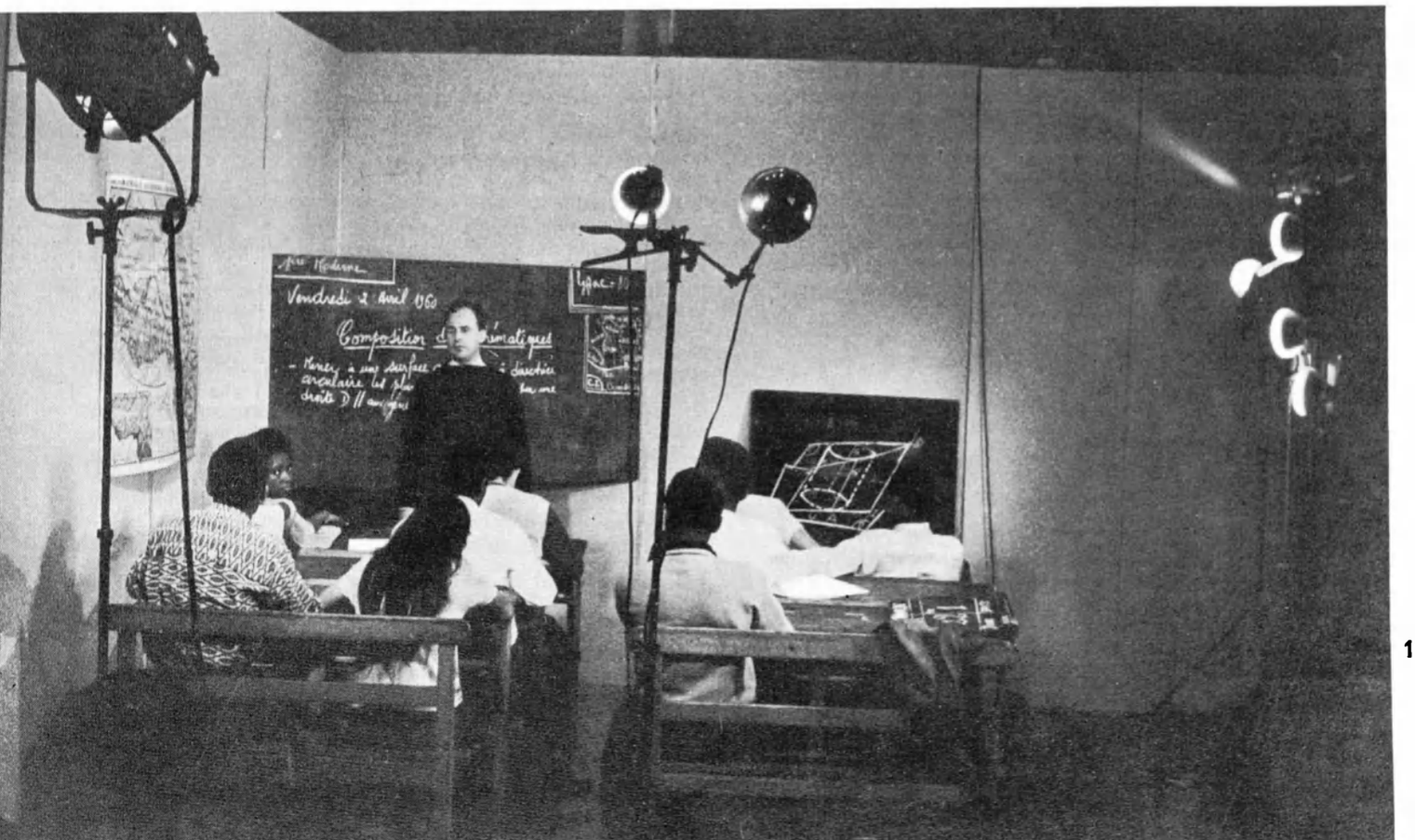
Cahiers du Cinéma

A recent feature film on tropical Africa is Jean Rouch's "*La Pyramide Humaine*" (The Human Pyramid) whose action is set in a secondary school at Abidjan, capital of the Ivory Coast. Below, a scene being filmed.



LIFE AMONG THE PEUHLS. For half a year the Swiss film-maker Henry Brandt lived the life of the Bororo Peuhls, a noble nomad people of the Niger. Wandering with them and their herds of cattle across the savannahs, he came to understand their ways and to love them. From his sojourn has come a film of extraordinary beauty and human warmth, "Nomades du Soleil" (Nomads of the Sun) and a book of the same title from which these photographs are taken.

AFRICAN CINEMA *(Cont'd)*

1950 — the great turning point

caravan journey to obtain salt. The same year G. H. Blanchon produced a short film in Guinea, *Coulibaly à l'Aventure*. Though completely ignored, it deals with one of the most important problems of West Africa—the migration of young people from the savannahs to the cities on the coast. This could have been one of the most valuable documentaries to come out of Africa if the film had not been ruined by an exasperating commentary.

It is only after the second World War that we find a valid African cinema developing both in documentaries and in feature films (1).

The last war indirectly helped the development of African cinema, for during this period army field services had to use portable film equipment, thus permitting 16-millimetre film, previously reserved for amateurs, to prove its worth.

The 16-millimetre movement was born immediately after the war and took hold particularly in France. French youth, emerging from the Occupation, from the armed forces or the Resistance, was seized with an irresistible wanderlust. The Musée de l'Homme, the anthropological museum of Paris, became a magnet for young Frenchmen eager to discover the world for themselves and thirsting for adventure.

Thanks to these young men probably the first real archives of recorded African music were assembled on tape and film. It was this more than anything else which made it possible to add authentic musical sound tracks to African films without resorting to outlandish and wholly inappropriate exotic music.

Certain black-and-white 35-millimetre films made at this time, such as *Danses Congolaises*, *Au Pays des Pygmées*, and *Pirogues sur l'Ogooué*, have remained the first top-quality images and sound recordings made in tropical Africa. These films are documentaries but they constitute exceptional records of the traditional dances of the Congo, the daily life of the Babinga pygmies, and canoe transportation on the Ogowé River in Gabon.

The year 1950 marks a turning point in the growth of African cinema. The films produced in the preceeding years had shown that the era of the cheap exotic film of prewar days was ended, and showed that there was a great need to learn more about Africa if the cinema were really to be used as a medium for telling spectators of other cultures about it. From 1950 until today African cinema has revealed five main tendencies.

◆ **1. EXOTIC AFRICA:** apart from the Tarzan films, in which Africa is only a mere pretext for the locale, a number of producers continue to work the vein of the "cannibal" and the "dance of the witch doctors." Here, as in prewar days, Africa is only a stage setting and the Africans themselves miserable extras.

(1) Note should be taken of a religious film, *Sœurs Noires* (Negro Nuns), shown in Paris in 1935 and in which the actors spoke Zulu. In the 1930s German film-makers made a number of films on Africa as part of the world-wide documentary series of EFA and Tobis films. From these perhaps came some of the sequences for *Melodies of the World*, by Walter Ruttman in Germany.

PEUHL LOVE SONG

Every maiden casts longing eyes at my herdsman with his Dangadela ox and Ruadduru cattle.

He has gone off to the salt hole with his herd.

The first bird in the sky to bring me tidings of his return shall have my joyful thanks.

Dear parents forgive me for being so madly in love.

If I should be separated from him for long, I would be like a woman in mourning; I would let down my hair;

For the first time the Peuhls will see a woman baptising her infant with her own hands, so great her happiness to have borne his child.

I shall call my baby girl Inna Ibba.

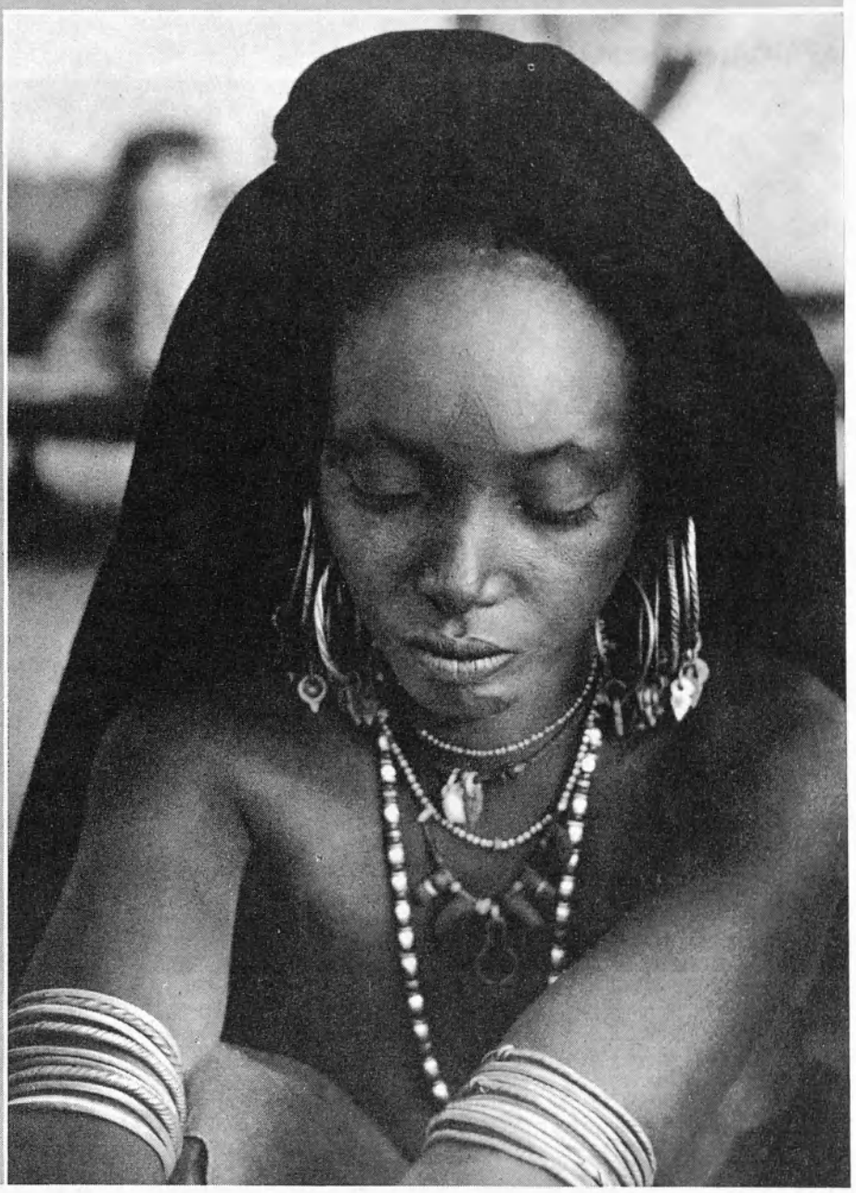
On our first outing we shall place her on the ox, and how proudly I shall lead it by the halter.

Only Inna Ibba shall sit upon the ox. At the salt hole, when we meet Bogue, herself enamoured of my beloved, her face will drop.

Though her father may offer him many cattle, she will not have my beloved.

He cannot be bought. He needs a true Peuhl woman able to charge a bundle with speed upon the ox.

Every evening we shall whisper together like two newlyweds, until the morning star rises on the horizon.



Photos from the book "Nomades du Soleil" by Henry Brandt,
© La Guilde du Livre and Éditions Clairefontaine, Lausanne.

◆ **2. ETHNOGRAPHIC AFRICA:** here we find film-makers and anthropologists attempting—clumsily at times—to portray the most authentic aspects of African culture. The influence of the ethnographic film has gone beyond the domain of scientific research, and has already greatly modified the approach of a large number of commercial films made in Africa.

In the field of the pure anthropological film the work of the Belgian Luc de Heusch deserves special mention. An anthropologist turned film-maker, de Heusch has attempted to use the motion picture as a supplementary tool in his scientific research. Though unpretentious, his films (such as *Fêtes chez les Hamba*, 1955) are conceived and executed with great care, and still remain as existing and authentic records of the cultures of the Congo prior to the disorders of the Independence period.

By contrast, Henry Brandt of Switzerland is a film-maker who turned to anthropology to make a film in Africa. In the 1950s Jean Gabus, director of the Ethnographic Museum at Neuchatel, Switzerland, led an anthropological mission to the Niger to study a nomad savannah people, the Bororo Peuhl herdsmen.

He later sent Brandt to the area where he spent half a year alone with the herdsmen. Brandt, using 16-millimetre, returned with a colour film of extraordinary beauty and a sound track with musical recordings of remarkable quality and authenticity. Jean Gabus had told him that his purpose was not to amass "museum documents" but to foster understanding and respect of other men (*"faire comprendre et respecter d'autres hommes."*)

His film, entitled *Les Nomades du Soleil* (Nomads in the Sun) and completed in 1956, is now considered a classic, although it has never been shown commercially. (Commercial distribution is now being arranged and the film will soon be shown in European cinemas—Editor.)

At first these experiments were not very well received in scientific circles. When an ethnographic film committee was set up at the Musée de l'Homme to teach anthropology students cinema techniques certain ethnographers raised the cry that more attention was being paid to "picture chasing" than to scientific research.

Despite such protests an important school of ethnographer-film makers specializing in Africa has now grown up and as a result the making of ethnographic films is being taken very seriously by the professional film world itself.

In 1951, the professional film maker Jacques Dupont turned out a really magnificent documentary, *La Grande Case* (The Long House) which he shot in Western Cameroon, and Pierre-Dominique Gaisseau, another professional, went off to Guinea to make a group of films, including *Forêt Sacrée* (Sacred Forest), *Naloutai* and *Pays Bassari* (Bassari Country).

◆ **3. CHANGING AFRICA:** films which attempt to show traditional Africa in contact with the modern world and the problems this raises (anthropologists call this "acculturation.")

Here, the cinema faces the same problems as does African sociology, principally that of ignorance— ignorance of the traditional cultures which are now undergoing

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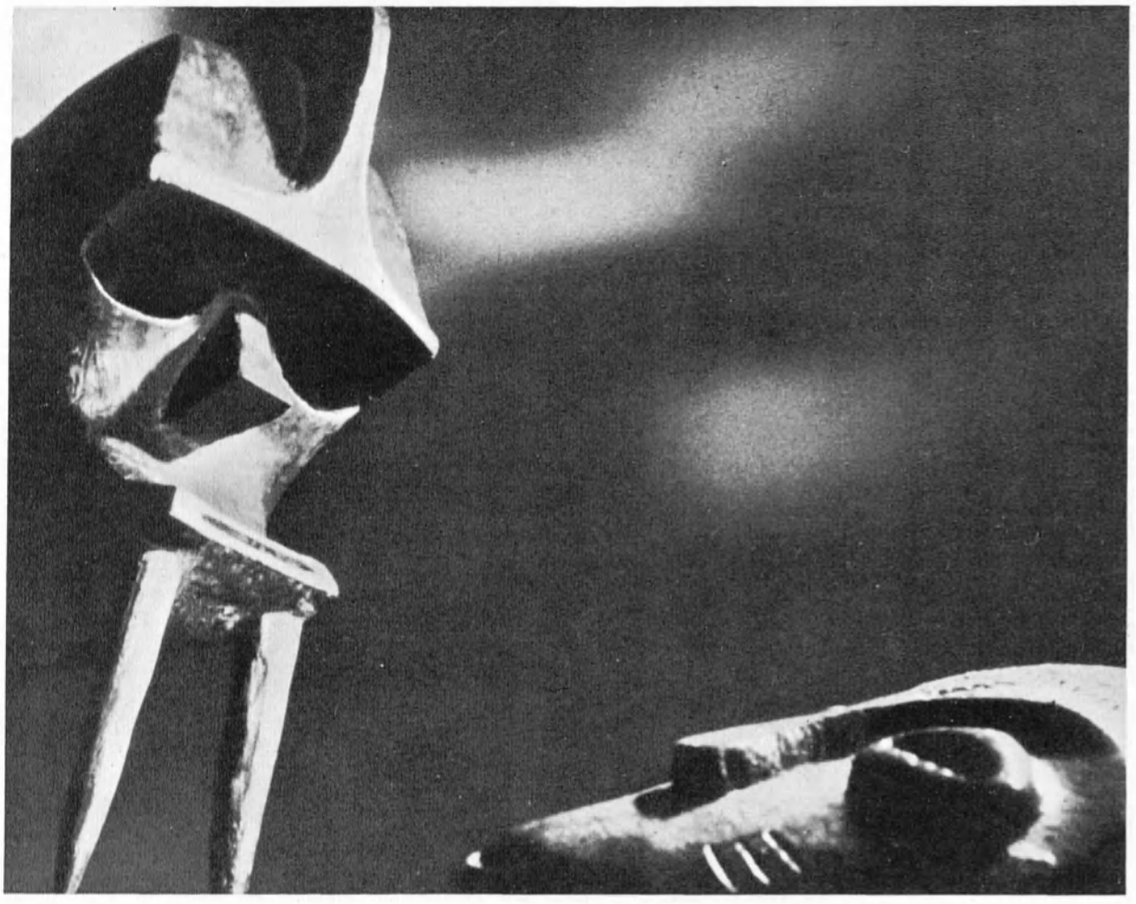


'STATUES ALSO DIE', say Alain Resnais and Chris Marker in a new French documentary. Their highly debatable theme: masks and statues are vanishing from modern Africa and their purpose is being lost. Our museum pieces are thus becoming meaningless relics.

Cinémathèque française

rapid change. This is no small handicap and it is evident in many films (mostly of the pro-national documentary type) where we find the old dying cultures disdained and ridiculed and little effort being made to understand them.

The first film on acculturation in Africa was the French documentary, *Coulibaly à l'Aventure,* made in 1936, and already referred to. Fourteen years were to pass before this subject was to be brought to the screen again. In 1950, a young student at the Institute for Advanced Cinematographic Studies (IDHEC) in Paris, named René Vautier, produced a clandestine film in the Ivory Coast on the struggles of a new political party then under attack by the colonial administration. Shot in 16-millimetre black-and-white with a makeshift sound track, the film, called *Afrique 60,* was banned in Africa and France and has been shown only on film library circuits.

Another banned film was *Les Statues Meurent Aussi* (Statues Also Die) made by Alain Resnais and Chris Marker. It was made up of sequences filmed in European museums dealing with Africa and supplemented by footage from film archives on which they did an extraordinary job of editing.

The theme was that the statues of Negro art in our museums are denatured because their true meaning is lost to us, and that the new African art influenced by the West is completely decadent. (An edited version of this violent film is scheduled to be released shortly-Editor.)

This was the period when African students at IDHEC began to make their first films in Europe (they were then unable to operate in their own countries.) A group consisting of Paulin Vieyra, Jacques Melokano, Mamadou Sarra and Jaristan (the cameraman) produced what is probably the first film ever made by Africans. Called *Afrique sur Seine* (Africa on the Seine) it portrayed the life of African Negroes in Paris. Unfortunately the editing and sound track were never finished.

Since 1950 films dealing with the theme of changing Africa have been produced in practically every country of tropical Africa. But in most of them (such as *Paysan Noir*—Black Peasant, *L'Homme du Niger*—Man of Niger or even *Sanders of the River)* Africa's traditions are viewed as archaic and unworthy of surviving alongside Western culture which is almost invariably taken as synonymous of progress.

But three films, I feel, merit special praise. One of them *Men of Africa,* was shot in East Africa, and describes the rivalry between educated Africans and the more primitive forest pygmies; Carlos Vilaredobo's *C'était le Premier Chant* (The First Song) in which a young French official tries to better the lot of a bush village community reduced to proverty by drought and lack of initiative; and *The Boy of Kumasenu* filmed by Sean Graham and the Ghana Film Unit in 1952. It is the story of a boy fisherman who abandons his lagoon village for the big city only to come face to face with crime and corruption and narrowly escapes becoming a delinquent himself.

Two films made by Claude Vermorel in Gabon and Guinea belong in a class apart. In *Les Conquérants solitaires* (Solitary Conquerors) and *La plus belle des Vies* (Best Way of Life,) Vermorel takes the opposite view on cultural change showing a European so taken by African cultures after getting to know them that he adopts their ways.

The political struggles for independence also inspired a number of films but very few, I feel, can be considered worthwhile.

◆ **4. THE TRUE AFRICAN CINEMA IN EMBRYO.** The films mentioned thus far were all attempts by foreigners to bring their own impressions and interpretations of Africa to the screen. But soon certain film producers began to feel that this was not enough, that a further step had to be taken to banish the exotic completely and to bring cinema audiences into direct contact with the people of Africa be they traditional or modern. This was to mark the first stage of the true cinema of Africa yet to come. And here again the modest ethnographic film was to play an influential role.

The first film of this kind came to us from South Africa, where as early as 1948 a South African pastor, the Reverend Michael Scott, produced a 16-millimetre film, *Civilization on Trial,* which showed the reaction of the Negro himself to racial segregation. A minor masterpiece was later achieved by Donald Swanson, of Great Britain, with his *Magic Garden* which recounts the unbelievable adventures of a Johannesburg thief. In similar vein is

First films made by African Negroes

Sean Graham's *Highlife* (renamed *Jaguar*) which he filmed in Ghana.

A much graver message—that of the very victims of racialism—was soon to come from South Africa when Lionel Ragosin, of the United States, filmed *Come Back Africa* in 1959. It is perhaps justifiable to ask whether this film is not Ragosin's own cry of despair against Apartheid rather than that of South Africa's Negroes. But whatever the director's role may have been the fact is that in his film it is the voice of Africa which speaks and he is no longer master of what he has unleashed.

For several years I have attempted to work in the same spirit. When I filmed *Les Fils de l'Eau* (Sons of the Water,) a traditional ethnographic picture, I did my best to avoid the trap of exoticism. Flaherty had shown me one way of setting up a documentary. As a director he arranged and built up a series of scenes from real life, divorcing them from their alien background thus rendering them accessible to audience the world over. But no one can hope to equal Flaherty's success in making the Eskimo *Nanook,* a real friend of people who had never even seen an Eskimo.

I therefore decided to try another way by letting Africans speak for themselves and putting on film their spontaneous comments on their life, their work and their opinions. In 1954-55 I tried this method with *Jaguar,* letting three young Nigerian emigrants tell the story of a more-or-less imaginary journey to Ghana. (This film is still unedited.)

In 1957, I carried out the same experiment in the Ivory Coast with *Moi, un Noir* (I am a Negro.) I showed a poor Abidjan stevedore, a silent film I had made on his daily life and asked him to improvise a commentary on it. The result was amazing. The stevedore, Robinson, was so stimulated at seeing himself on the screen that he improvised an extraordinary monologue in which he not only reconstructed the conversations filmed but commented on them and even criticized himself and his friends.

◆ **5. AFRICAN CINEMA BY AND FOR AFRICANS.** I think we have now gone as far as we can working along these lines. No matter what we attempt neither Ragosin nor Graham nor myself will ever be Africans, and our films will always be films on Africa made by foreigners. I am not implying that there is anything really wrong with this, and it will certainly not stop us from continuing to make African films.

But it is time for a Changing of the Guard. In fact it has already started with the technical training of African film-producers. Paulin Vieyra, the first African to study at the Institute for Advanced Cinematographic Studies, has been teaching in Dakar for the past several years. He has made a film, slightly clumsy though it may be, called *Un homme, un idéal, une vie* (A man, his ideal and life) about the frustrations of a fisherman from the coast of Senegal who defied tradition by installing a motor in his canoe.

The film does not pass judgment on African traditions, it simply states them, depicts them. And when in one scene the trees of the forest speak and take part in the council of the village elders, there is not even a hint of mockery.

Lack of funds have prevented the film from being completed, but Vieyra has other plans; he is no longer alone. To mention only French-speaking Africa, it is to him and his colleagues, Blaise Senghor, Timité Lassari, Thomas Coulibaly, Jean-Paul N'Gasza and others that we must look for the films we all so eagerly await.

JEAN ROUCH *is Secretary-General of the Committee for Ethnographic Films at the Musée de l'Homme, Paris and Director of the French Institute for Tropical Africa, Niger.*

Tony Saulnier

WRITTEN IN THE SAND. Decorative design is allied to beauty of gesture in this movement captured by Pierre Gaisseau in " Forêt Sacrée" a film about the Toma people of Guinea.

TOMORROW'S WEATHER

Will artificial satellites give us the right answers?

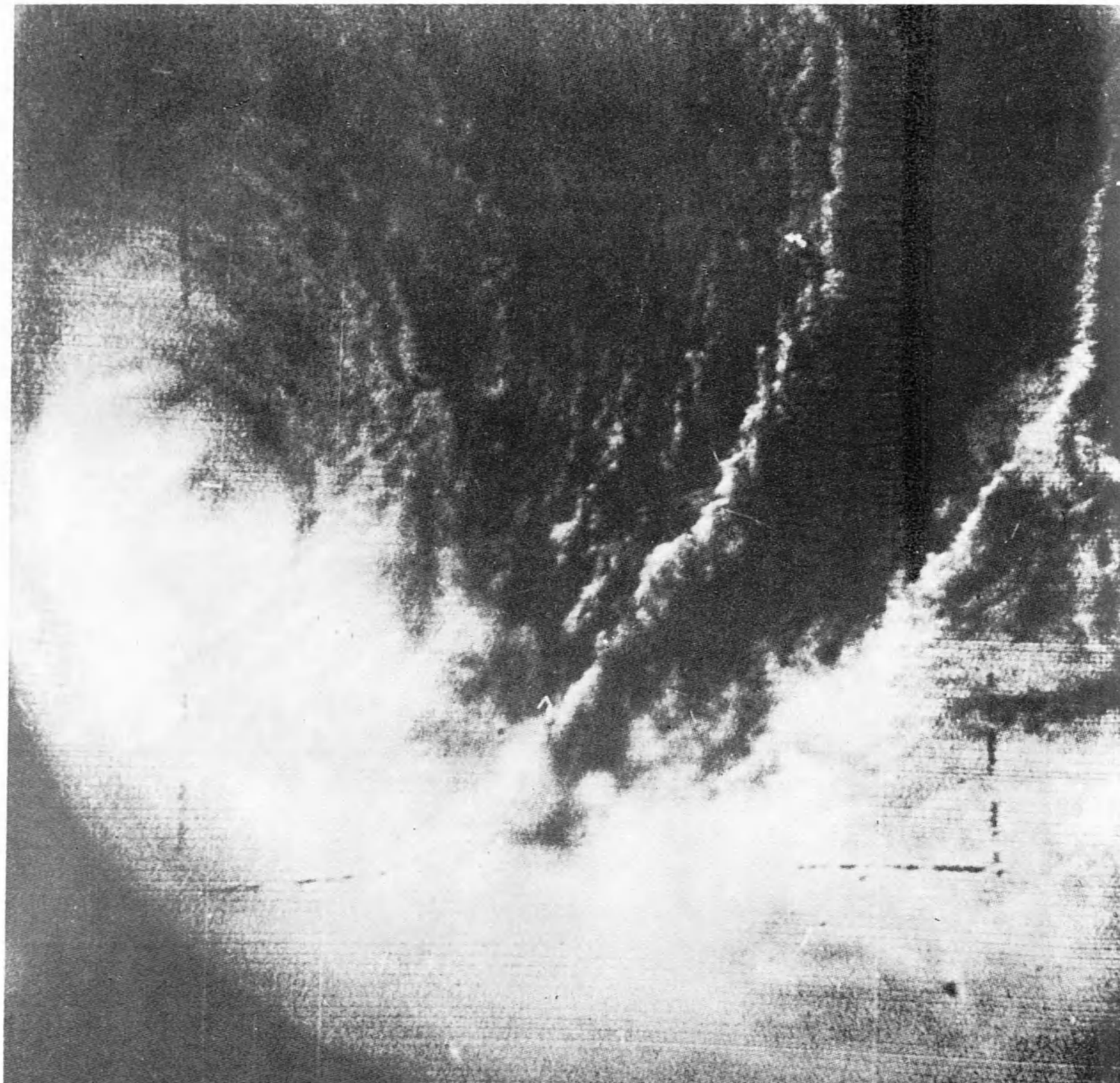
by Daniel Behrman

ARTIFICIAL satellites able to measure the sun's heat beyond the earth's atmospheric interference, and electronic computers working in conjunction with a "mathematical model" of the earth, are among the means by which science hopes to solve one of the world's most stubborn mysteries: the climate.

This was brought out by a recent symposium on changes of climate—particularly as they affect arid lands—which drew 100 scientists from thirty-five countries to Rome on the invitation of UNESCO and the World Meteorological Organization.

But the mystery is a long way from a solution. While scientists can tell us the exact position of Mars 500 years from now, they are still unable to produce absolutely reliable forecasts about next week's weather. As for the climate next year or in the next decade, a problem of vital interest to agriculture, these are impossible to predict.

The symposium certainly refuted a good many explanations which have been advanced for recent changes in the weather. Generally speaking, world temperature averages grew steadily higher from the 1850's to the 1940's, and this warm spell has opened Arctic ports, enabled Iceland to



Photos WMO, Geneva

CYCLONES SEEN FROM SPACE. The remarkable photos on these two pages show two cyclones as they look from a height of 400 miles. They were taken by the U.S. weather satellite "Tiros". Above, cyclone cloud formation in the Pacific, 800 miles off southern California. Opposite, another cyclone moving some 300 miles north of New Zealand. Both extend over hundreds of miles of the earth's atmosphere. The "eyes" and spiral cloud bands of tropical cyclones, such as hurricanes and typhoons, have been studied by means of radar and aircraft photographs, but a picture of a complete typhoon structure as seen from high levels had never before been taken until "Tiros" snapped the one north of New Zealand. Such photographs help to explain both fair and foul weather situations, how storms mature and finally dissipate themselves.

grow barley, melted permanent ice in the Scottish Highlands and lured a steady run of codfish to the coasts of Greenland. These warm years, with their economic implications, have led to a number of theories, notably one that man is changing the weather by burning fossil fuels and releasing millions of tons of carbon dioxide into the atmosphere.

Unfortunately for the theoreticians, this rising temperature curve levelled off around 1940 and has now dipped. Temperature averages have dropped (only half a degree Fahrenheit, to be sure) in the Arctic and just about everywhere except for the United States, Western Europe and the Pacific Coast of Asia.

People who blame colder weather on air pollution or atomic explosions get no support from climatologists. Changes of climate in the past have been far greater than any we are witnessing today and they were brought about without the relatively limited influence of man.

One fact clearly brought out by the Rome symposium is that, generally speaking, the study of climate is still a process of hunting for the missing pieces of a puzzle, it has not yet reached the stage where the puzzle can show any definite pattern.

A number of scientific disciplines are engaged in collecting these pieces. Meteorology, oceanography, geography, hydrology, geology, glaciology, plant ecology, paleobotany and archeology were among the specialized branches represented in Rome.

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Is the heat from the sun growing weaker?

The first requirement for a preview of the future is a clear view of the past. Weather records have only been kept systematically for about 150 years—a split-second compared to the geological time over which the great changes of the earth's climate have occurred. This explains why many climatologists are studying ancient chronicles and classical literature for more clues to the weather of the historical past. A British delegate to the symposium told how he is now reading through ships' logs compiled at the end of the 17th century.

Beyond the limits of written records, the archeologist has a contribution to make. Here, methods of dating finds by measuring their radio-active carbon content have proved valuable; this system of dating is also used to determine the age of fossil tree-ring samples (the tree rings themselves can indicate wet or dry years).

Fossil pollen is also an important clue to weather. The symposium in Rome heard a French paleobotanist report that, on the basis of pollen finds, he estimates the Sahara desert to have advanced northward 1,500 miles in 4,000 years. The Sahara, now in the driest stage of its arid history, once supported a Mediterranean type vegetation and a grazing economy.

This trip through the past takes the climatologist into geological time. Here, he encounters the Ice Ages which are the biggest single factor in our weather. As one leading meteorologist pointed out, we are still living in an Ice Age. Ice on the earth's surface is not a "normal" condition. We still have the mountain glaciers and the polar ice masses which appeared during the Ice Ages. Only the continental glaciers have disappeared.

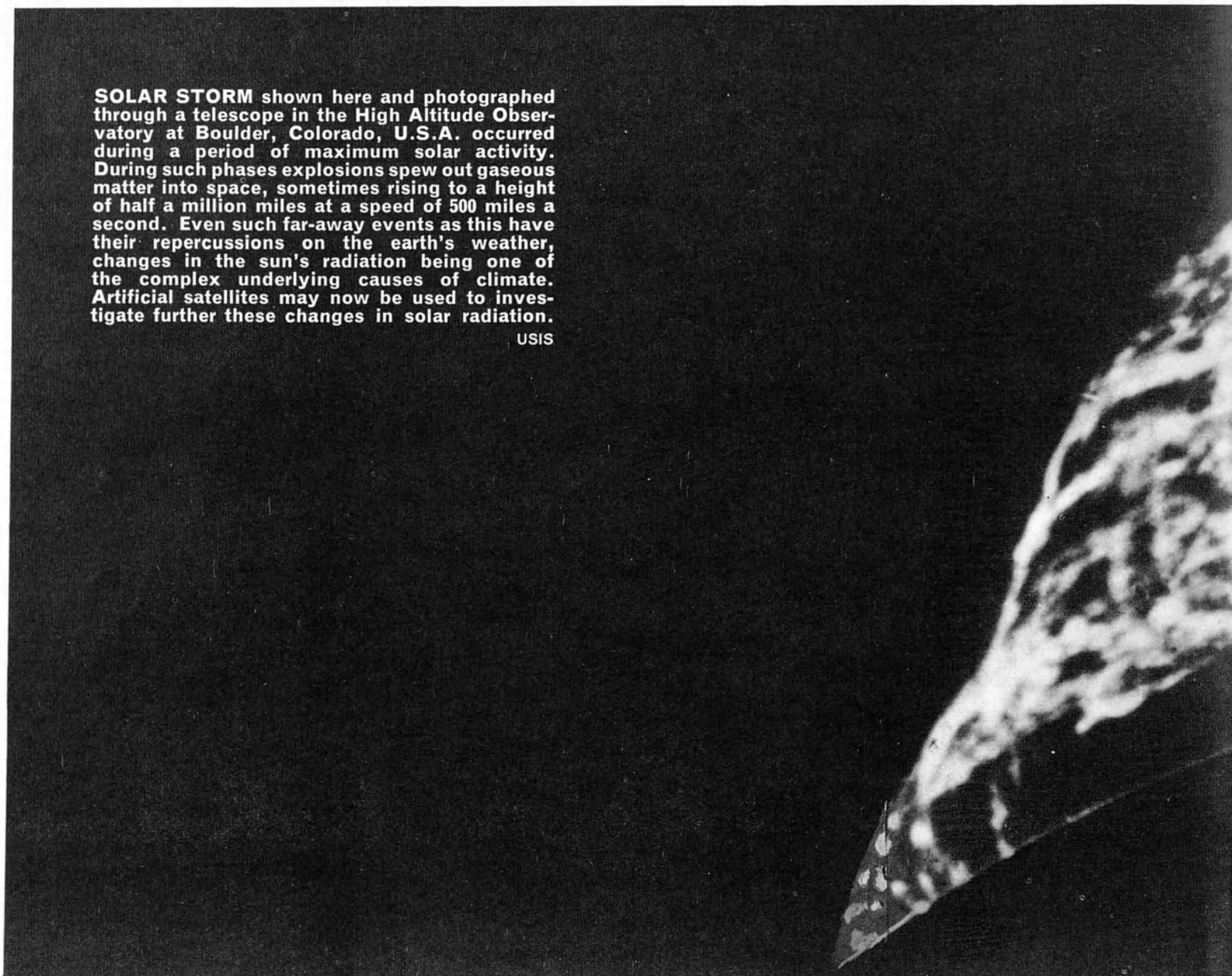
Scientists are the first to admit how far they still are from solving the mystery of climatic changes. Dr. R. C. Sutcliffe, director of research in the British Meteorological Office, put it this way: "There is still no basic theory as to why the climate changes. We are in the same stage as pre-Newtonian astronomy: we observe phenomena but we have not worked out laws to explain them."

Electronic computers have a part to play in determining these laws, if they exist (there are mathematicians who will tell you that the earth's climate in the recent past is like a big roulette wheel running on the law of probabilities!). In the United States, however, computers are already being used with a mathematical model of the earth though this "earth" is a uniform land mass without oceans.

Artificial satellites will be able to settle a controversy over the influence on the climate of changes in solar radiation. Whirling high above the atmosphere, the satellites will decide if the intensity of the sun's heat is actually changing or if variations recorded on earth are the result of other factors.

THOUGH they seek some of the basic causes of weather in places as far away as outer space, climatologists also place great stress on minor fluctuations which may not seem important statistically but which can make an enormous economic difference to agriculture in semi-arid regions.

Dr. Robert O. Whyte, head of FAO's plant production and protection division, pointed out that farmers in the 2,500 mile African dry belt from Dakar to Khartum assume a risk of crop failure once every ten years. If this rate should rise to two or three failures in a decade, then the face of the region will change.



SOLAR STORM shown here and photographed through a telescope in the High Altitude Observatory at Boulder, Colorado, U.S.A. occurred during a period of maximum solar activity. During such phases explosions spew out gaseous matter into space, sometimes rising to a height of half a million miles at a speed of 500 miles a second. Even such far-away events as this have their repercussions on the earth's weather, changes in the sun's radiation being one of the complex underlying causes of climate. Artificial satellites may now be used to investigate further these changes in solar radiation.

USIS

At the final meeting in Rome, Mr. C.C. Wallén, Deputy Director of the Swedish Meteorological and Hydraulic Institute, outlined some of the problems that are to be tackled by future international research.

"It is true that the clue to the cause of changes in the earth's climate might be found in studies of the heat balance by itself," he said, "but it must be admitted that it would be even more interesting to know also how a certain change in the heat balance would influence the general circulation and ultimately the climatic elements. No doubt the new possibilities with electronic computers in the statistical treatment of changes in the general circulation on one side and data obtained from satellites will play a dominant role in the future development of studies of causes of climatic changes as related to the general circulation.

"On several occasions during this symposium, the significance of climatic changes for vegetation, fauna and man's activity has been referred to. Most meteorological scientists dealing with the problem have, of course, no particular reason to consider this aspect. However, in the last fifteen years geographers interested in the relation between man and nature, as well as international organizations working for the benefit of mankind, have shown a growing interest in this side of the problem. As mentioned, the implications for vegetation, fauna, agriculture, fishery and sea trade of the "recent climatic fluctuations" have been enormous."

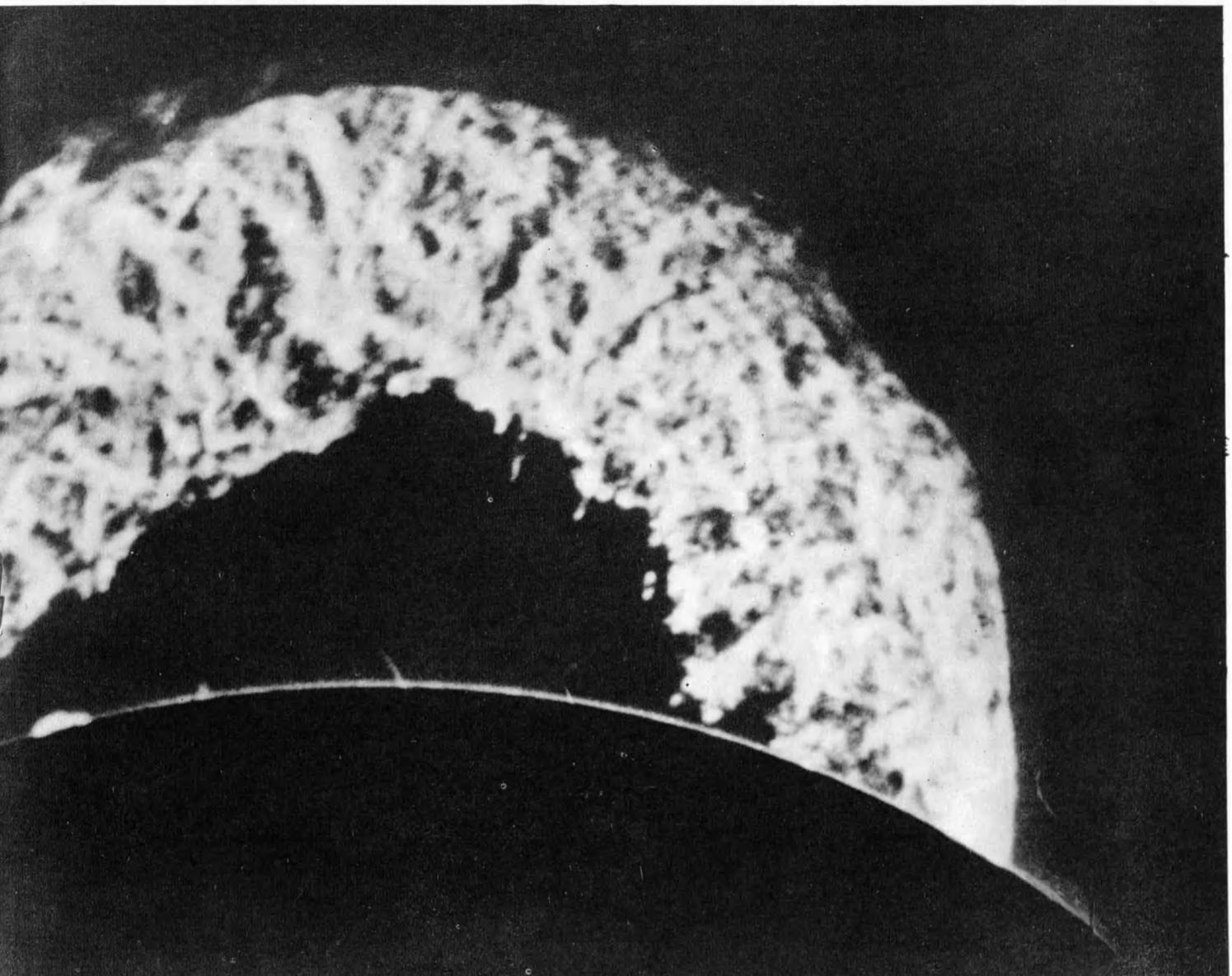
"In connexion with its arid lands programme," UNESCO has become increasingly interested in climatic fluctuations in arid and semi-arid parts of the world. Many of those areas, where we are now trying to extend settlement and agriculture, are considered by many to have been set out and used for dry-farming or irrigated in ancient times. A highly interesting aim of future development within the field of climatic fluctuations will, therefore, be an attempt to establish the changes of the margin of the arid and semi-arid lands which have occurred in historical and prehistorical times.

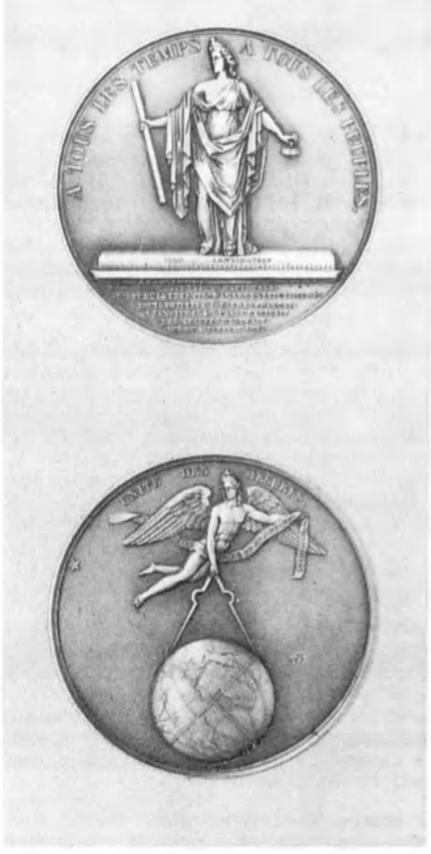
"The interrelation between true changes of climate caused by extra-terrestrial influences or large-scale fluctuations in the general circulation of the atmosphere, on the one side, and, on the other, the influence of man on natural vegetation and soil erosion conditions, which may seem as caused by a true change in climate, is a basic problem that we have to face in dealing with all practical consequences of climate fluctuations in both ancient and recent times.

"In order to investigate this interrelation, it is first of all essential to know the present climatic situation and the way in which natural vegetation, agriculture and climate are related to each other. The joint UNESCO-FAO-WMO project to study the agroclimatic conditions of semi-arid parts of the Near and Middle East will give a firm basis to the understanding of the agroclimatic conditions in that part of the world.

"I FEEL that this project should be followed up in at least one pilot area within the region by a contemporary study of the climatic development and man's influence upon climate by reforestation and irrigation. This is a long-term project which has to go on for a considerable time, but it will be the only possibility of obtaining an idea of the order of magnitude of the changes caused by man in relation to those caused by true fluctuations in climate."

In these semi-arid lands man wields an important influence over microclimates and much further study is needed on the effects of deforestation, grazing, and irrigation. Once conclusions can be reached from such data, then the meteorologist will be able to indicate the actual odds involved in large-scale land development programmes on the fringes of the arid zone. Steps are already being taken in this direction to designate land for agriculture, grazing or lying fallow on the basis of climatological findings.





Courtesy Int. Bureau of Weights and Measures

"**FOR ALL TIMES** and all peoples", says the inscription on this medal by which France in 1799 planned to mark the introduction of the metric system. In fact it only became the country's legal and compulsory system of measurement in 1840. The metric system has now been adopted by about 100 countries.

THE STORY

A centuries-old battle against chaos

by Mme Luce Langevin

ALTHOUGH little recognized as such, one of the greatest contributions of the French Revolution to Europe and to science throughout the entire world was the metric system," wrote the American chemist, S. French.

To appreciate the full force of this remark, we should bear in mind the almost unimaginable confusion in the weights and measures used throughout the world before the French Revolution.

It was in France more than anywhere else that the inconsistencies were greatest. Measures varied not only from province to province but often from town to town, and the same name frequently applied to different measures.

Let us take a few examples from the French Encyclopædia of the eighteenth century.

The definition given for the foot is "a measure of all articles of commerce." The "King's foot" or "Parisian foot" equalled 12 inches, or 144 lines (since there were 12 lines to an inch.) But, so we are told, there were 120 lines to a foot at Rouen, 150.30 at Dôle, 128.27 in the city of Strasbourg, and 130.90 in the area surrounding Strasbourg.

There was similar confusion in regard to another measure of length the *aune* (ell), which was used for cloth and which varied not only from region to region but also according to the kind of cloth being measured. In Paris, for instance, there were 3 feet 7 inches 8 lines, i. e. 524 lines, to the *aune* for linen, 526.40 lines for woollen fabrics and 527,50 for silks. At Lille, there were 305, and at Saint-Malo, 597 lines to the *aune*.

Another measurement of length, the *toise*, is cautiously described as "a measure of size differing according to the place where it is in use." The "Parisian *toise* equalled 6 "king's feet".

In addition to the foot, the *aune* and the *toise*, there were various other measures in use, including the Parisian *perche* (18 feet) and the French *perche* (22 feet). The nautical league was common to France, England and the Netherlands (maritime connexions between the three countries were then close), but the land league was different in each province, and the farther one went from the centre of France the longer it became.

Square measures and measures of capacity were still more confused than long measures. The word *arpent*, for example, which was an old Gaulish measure, was used for an area measuring 100 square *perches*; but in the case of the Parisian *arpent* the *perche* equalled 18 square feet and, in the case of the French *arpent*, 20 square feet.

Speaking of another measure, the *journal*—the area that a farm labourer could plough in a day—the great chemist Lavoisier, who was at that time a *fermier général* (a financier, responsible for the collection of taxes), said: "It is a frightening thought that, in the subdivision of Péronne alone, which is comparatively small, there are 17 different *journaux*."

The "dry measures"—*boisseau, rasière, setier, muid* and

CONT'D ON PAGE 22

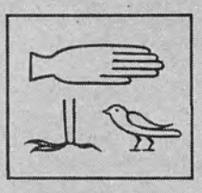
THE ENGLISH YARD was established by King Henry I in 1101 as the distance from the point of his nose to the tip of his second finger. Drawing shows monks checking this royal measure. Britain has not yet adopted the metric system but its meteorological services are now to publish centigrade temperature figures alongside Fahrenheit ones. British and U.S. scientists have long used metric measures.

OF THE METRIC SYSTEM

SIXTEEN MEN MAKE A 'ROOD'. A 16th century German treatise describes how to establish the length of a "rood" (today the English rod, pole or perch —5 1/2 yards in length). "Stand at the door of a church on Sunday and bid 16 men to stop, tall ones and small ones, as they happen to leave at the end of the service. Make them put their left feet, one behind the other, and the length thus obtained shall be a right and lawful rood to measure and survey the land with, and the 16th part of this measure shall be a right and lawful foot."

Drawings from "Mass und Gewicht" by H.J. Von Alberti, Berlin, 1957

TO EVERY MAN HIS MEASURE

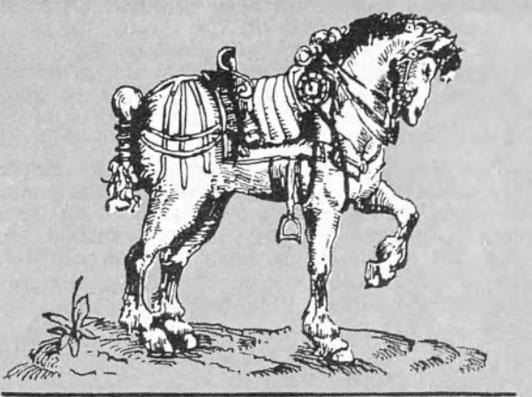


Thousands of different measures and weights used in ancient Egypt have been identified. The hieroglyphics at left represent two measures of distance. Hand denotes a measure of five fingers width. Below it is a sign for a "small span" the width of 12 fingers.

"Man is the measure of all things," said Protagoras, the first of the Sophist philosophers. From far off antiquity to our own times the human body has been used to define units of measurement—finger, hand, cubit (from elbow to middle finger tip) foot and yard.

Sometimes man has fixed his measures in terms of his physical prowess—the length of a bow shot, the distance his voice would carry. In Tibet peasants once used a "cup of tea" measurement. This was the distance which a man carrying a scaldingly-hot cup of tea could run before the tea cooled off to a drinkable temperature.

In 16th century France, Jean Fernel, a reputed court doctor, mathematician and astronomer, used a mechanical distance recorder of his own invention to establish the distance from Paris to Amiens. Fernel fitted his device on a horse (above)



but it worked equally well on a man. It was activated by each step taken and a bell tinkled after a certain number of paces had been covered. This pedometer created a sensation in the 16th century and was remarkably accurate. It is believed that similar devices were used in Alexandria 1,500 years earlier.

Europe's weights varied from city to city

sac—which were used for grain, and the "liquid measures" —*barrique, pot, pinte, chopine* and *feuillette*—which were used for liquids, varied incredibly both from region to region and according to the commodity being measured.

In old French measures of weight, however, things were less chaotic. The "marc weight" or pound was used more or less everywhere throughout the kingdom; so was the half *livre* or *marc*, and the *quarteron* which was a quarter of a *livre*. These weights were in the form of goblets which fitted into each other and made a pile, called "Charlemagne's pile." It weighed 50 *marcs* altogether.

Yet France was not the only country where the situation was so chaotic. The system of weights and measures was fairly complicated, too, in the other countries of Europe, though to a lesser degree than in France.

In England, for example, the yard was not the only measure of length—there was also the pole, the English ell (3 feet 9 inches) and the Flemish ell (2 feet 3 inches). There were two standard yards, one deposited with the Royal Society in London and the other with the Court of the Exchequer, but there was an appreciable difference between the two—which seems to have passed unnoticed until 1791.

In the United Kingdom there were two different measures of weight, according to the commodity being measured. Troy weight was used for gold, silver, precious stones, medicines and seeds. The pound avoirdupoids was used for metals, wool, fibre, leather, groceries and bread. One hundred Paris *livres* or Amsterdam pounds corresponded to 109.9 London pounds avoirdupoids, 166 Venetian pounds and 146 Roman pounds.

The most widely used long measure, the *aune* (ell), also varied in value from one country to another.

The origin of this variety of measures, which was common to all the countries of Europe, is to be found in the institution of the feudal system.

When the countries of Western Europe were part of the Roman Empire, they all used the same system of weights and measures—the Roman system—which had been imposed on them, and whose standards were kept on the Capitol in the temple of Jupiter. Later, Charlemagne realized that a uniform system of measures was an invaluable aid in maintaining the unity of his vast empire. The measure of length, namely, the "king's foot" and the weights of Charlemagne's pile were kept in the Imperial Palace.

But after the death of Charlemagne the empire was split into small states, principalities and fiefs, each lord being absolute master of his own lands. He thus fixed measuring standards exactly how he wished and this right was one of his most cherished prerogatives as he could modify it to his own advantage. Each fief thus gradually became a small independent economic entity.

Nevertheless the economic development in this feudal society, which saw the improvement of craftsmen's techniques, the appearance of the first manufactured goods, urban development which led to a greater exchange of goods between town and country and great journeys of exploration by land and sea, led to a tremendous expansion of markets.

At the time of the Renaissance in Europe, whenever a peasant left his own village or a merchant traded with cities other than his own, he found he was dealing with different weights and measures. This was the situation existing in France on the eve of the Revolution. The bourgeoisie which ran the country's economy needed a unification of measuring standards to encourage business and trading which by now was being carried out on an entirely new scale.

"The idea of standardizing weights in France is possibly as old as the monarchy itself," one French historian has written. From the 13th century on, numerous royal decrees were promulgated in an effort to standardize weights and measures. But the only success achieved was that the "marc weight" pound was adopted throughout the country for the minting of coins.

In the 17th century a council for reform set up by Colbert was defeated by the complexities of the problem. The following century Necker also studied the question but had no more success in finding an answer to it.

Nevertheless the movement towards reform was gathering momentum and the basic principles of the metric system were being more and more widely accepted among scientists, philosophers and economists.

The need for universally accepted, consistent and accurate measures also corresponded to the new requirements of science and especially of physics. In the hands of men like Galileo, Descartes, Huygens and Newton, physics had made sudden and rapid progress and was now a real science. If the figures arrived at in measuring objects were to be of any scientific value, the units used by scientist had to be clearly defined and absolutely constant. Standard scientific measurements were therefore essential.

Musée du Conservatoire National des Arts et Métiers, Paris

THE PILE OF CHARLEMAGNE was the 8th century measure of weight of the Holy Roman Empire used in France as late as the 19th century. The 15th century version shown here consisted of 13 copper weights (left) nesting in each other, On the right the decorated case which held the weights.

The time unit—the second —had been fixed long before, because of requirements of astronomy and its practical use in navigation. But every scientist had long made do with measures of length and weight which were his own personal property, approximating as near as possible to the Châtelet *toise* or the Parisian *marc*. With the rudimentary techniques for measuring available at that time, the measures reproduced from the standards varied considerably.

After Huygen's famous study of clocks and the isochronism of oscillations, scientists and philosophers gradually came to the conclusion that they should take as the unit not an arbitrary length such as one related to the human body—such as the *toise*—but an invariable, universal length of which nature itself would ensure the constancy.

In 1670, Christopher Wren put before the Royal Society in London the proposal that this constant unit should be the length of a pendulum which swings once in half a second. The same year, the Abbé Picard, an astronomer of Lyons who was renowned for measuring the arc of the meridian in France, determined the length of the pendulum which swings once a second in Paris, and put forward a proposal that "the length of the pendulum swinging once in one second might be called the *rayon astronomique*; one-third of this length would be a foot and twice this length would be the universal *toise*.

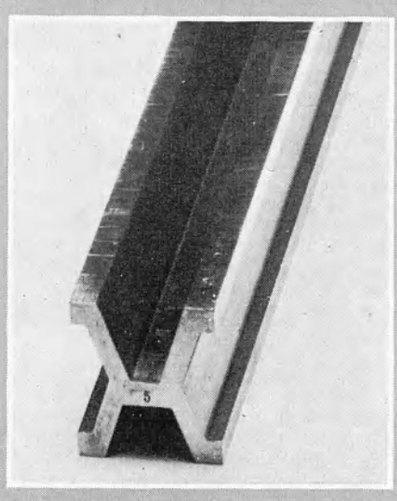
But the experiments conducted by the astronomer Richer at Cayenne, French Guiana, in 1672 showed that the length of a pendulum which swings once a second is shorter at the equator than in Paris. This, therefore could no longer be regarded as a universal measure. But the idea of using the pendulum was not abandoned.

In the eighteenth century, this unit was still used by some scientists, including some of the members of the Royal Society in London, Jefferson in the Unites States and La Condamine in France. La Condamine was requested by the Académie des Sciences to measure the arc of the meridian in Peru.

CONT'D ON PAGE 24

A historic moment:

CASTING METAL FOR THE OFFICIAL METRE



On May 13,1874, a casting of 250 kilogrammes of platinum-iridium metal was made (above) at the Conservatoire des Arts et Métiers, in Paris. From this alloy international prototypes of the metre and the kilogramme were to be made, but tests revealed slight impurities. A new and purer alloy was cast in London and from this 30 metric bars were drawn. The same alloy was adopted for the standard kilogrammes. These international metric standards are today stored with infinite precautions in the International Bureau of Weights and Measures near Paris. Left, the end of an X-shaped prototype metric bar and, right, the international kilogramme under its protective glass covers, with, alongside, tongues used for handling it.

A pioneer among the world's international organizations, The International Bureau of Weights and Measures came into being in 1875 after the Convention on the Metre was signed by 18 countries. These States agreed to set up the Bureau as a permanent institution in Paris, the birthplace of the metric system. Right, delegates to the Second General Conference on Weights and Measures (1895) came from 15 European countries and from Mexico and Japan. At the most recent of these conferences in October 1960, delegates from 33 countries adopted a new method of determining the length of the metre (see photograph page 25).

Photos Courtesy Int. Bureau of Weights and Measures

Reform born of the French Revolution

On his return, in 1748, he had cast a bronze rod the same length as the second-pendulum at Del Quito and sealed it in marble with the inscription: "A natural unit —may it become universal!" In his report to the Academy, La Condamine stressed both the need to adopt the decimal division and the need to choose "a fixed, constant measure, taken from nature itself, and one that is verifiable in any century."

La Condamine's plan was not the only one put forward by scientists. Another natural unit related to the size of the earth also had its ardent supporters. The idea first came from the Abbé Mouton who in 1670 suggested that the unit adopted should be the sixtieth part of one degree of latitude, i. e., of the arc of one minute, which be called the *mille*. The *centuria* and *decuria* were to be multiples of the *mille*, and the *decima* and *centima* submultiples of it.

He was the first to propose the adoption of the decimal division and stress its importance, and the remarkable system of measures that he suggested contains the germ of our entire metric system as it is today.

It was not until the Revolution that the material, social and political conditions necessary for this reform came into being. The question was raised in the Constituent Assembly in 1790. Talleyrand rejected the *toise* and the *livre*. "It is not enough," he declared, "to adopt one unit of weight and one unit of length instead of many. . . the system must be perfect—it must be based on a constant model, found in nature, to which all nations would be able to resort."

The scientists had proposed two different natural units. Of these Talleyrand favoured the length of the pendulum with a swing of one second, at "the mean latitude of the civilized world," i. e., 45 degrees, rather than the unit based on the length of the meridian. So as to win the confidence of the peoples, he advocated that new measurements should be taken—"solemnly" and in collaboration with the Royal Society of London. This collaboration was facilitated by the fact that on January 13, 1790, John Miller had proposed, in the House of Commons, the introduction of a standardized system of measures based on the length of the pendulum swinging once a second in London.

TALLEYRAND'S plan was adopted by the Constituent Assembly, and the Decree of May 8, 1790 is the first statute concerning the reform, which thus seemed to be on the point of realization not only in France but also in England and the United States. Moreover, plans already existed for co-operation on this subject between the Royal Society in London and the Academy in Paris.

In the United States, the standardization of weights and measures had been decided upon in 1787 when the Constitution of the Union came into being; the length of the second-pendulum at the mean latitude of the United States (38 degrees) had been selected as the unit. Jefferson, favourably disposed to the French philosophers, persuaded Congress to agree to the length of the pendulum at 45 degrees latitude and to follow closely the work being done in France and England.

For political reasons, however, the standardization of measures between these three great countries was not to come about. A few days after the decree was promulgated, the plans were upset by a threat of war between England and Spain—France being an ally of Spain. On November 30, England announced that the arrangement was "impracticable."

"It is much more natural," stated a report of the French Academy. "to measure distances from one point to another in terms of a quarter of the earth's great circles than in terms of the length of a pendulum."

The proposal put forward by the Academy was approved at once, and, on March 30, 1791, the scientists' choice prevailed. The unit of length, which was defined as the ten-millionth part of a quarter of the earth's meridian and was called the "metre," was adopted as the basis of the metric system.

However, all sorts of difficulties arose in connexion with the implementation of the project. The work which the academicians had estimated would take two years was far from completed when the fixed date was reached in 1793. The production of the measuring instruments needed by the various commissions was considerably hampered by the poor quality of scientific equipment available in France.

After the Revolution, France tried to give fresh impetus to the manufacture of measuring instruments, but the commissions had in fact to wait nearly two years before they could begin their work.

Even when the technical difficulties involved in the production of equipment had been overcome, other disappointments awaited the scientists. The Revolution had many enemies, both in France and abroad. France was rent by the counter-revolution and threatened by invasion at the time when Delambre began, starting from Dunkirk, to measure his assigned section of the meridian.

Harassed by the suspicions of the people and the local authorities, he was continually forced to have his instructions verified; sometimes even his life was in danger. In Spain, his colleague Méchain was encountering other difficulties. Spain had agreed to collaborate in the work on triangulation, but it refused to allow Méchain to return to France once the two countries were at war.

On December 21, 1792, the working out of a detailed plan for reform was given to the Comité d'Instruction Publique.

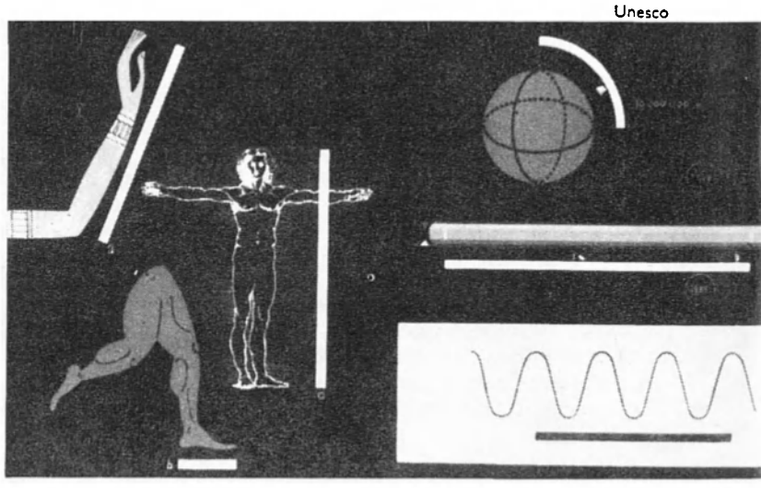
On May 29, 1793, Borda, a member of the Commission appointed by the Academy, announced the general outline of the system proposed by the Academy. The principle of the basic relations between the units of long measure, square measure, cubic measure and measures of capacity and weight was the decimal system. The length of the metre, calculated from the results of the measurements of the meridian carried out by the Abbé Lacaille in 1740, was selected as the basis of the system pending the completion of the geodesic operations.

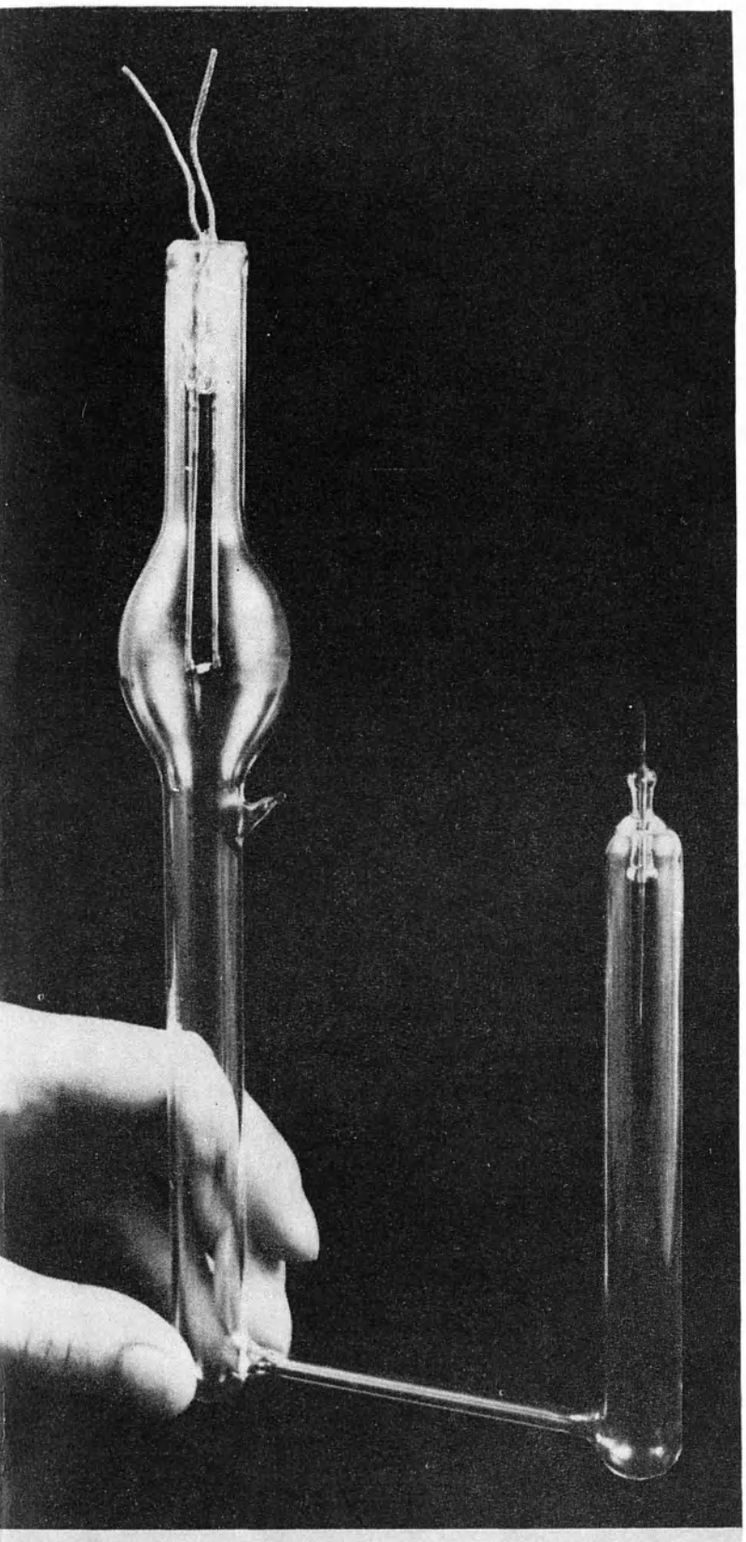
The new measures—the metre, the gramme and the litre —and the new monetary unit, the franc, were to have become compulsory on January 1, 1794. By that date, however, France being at war, nothing was ready. Owing to difficulties in applying the law, it was decided to introduce the new units gradually.

The metric system was actually established by the Law of 18 Germinal, year III of the Revolutionary calendar (April 7, 1795) which determined its final nomenclature and prescribed the practical steps to be taken for the introduction of the new weights and measures throughout the Republic.

In September 1798, it was to Talleyrand, at that time Minister of Foreign Affairs, that fell the task of issuing invitations to this first international congress on weights and measures. Denmark, Spain, the Swiss, Dutch, Ligurian, Roman and Tuscan Republics, and the Kingdom of Sardinia sent representatives to Paris to acquaint them-

Unesco





Courtesy Int. Bureau of Weights and Measures

ACCURATE TO 1,000 MILLIONTH

Up until 1960, the precise length of the metre was fixed as one ten-millionth part of the distance between the North Pole and the Equator (shown at left with earlier measurements, based on parts of the body). But scientists needed more precision and on October 14, 1960, adopted as a new unit the wavelength in vacuo of the orange light emitted by the gas Krypton 86 when an electric current is passed through it. The new standard can give an accuracy of one thousand millionth of a metre. Above, the special lamp containing Krypton gas with which the metre can now be determined 200 times more accurately than by the previous method.

selves with the work that had been done and to attend the official inauguration of the new system.

The rules employed in measuring the bases were compared, geodesic and astronomical operations were proved, calculations were checked and the value of the kilogramme was finally established.

Le Corps Législatif, meeting in solemn session in Paris on June 22, 1799, received a commission consisting of French and foreign scientists who handed over two bars and two cylinders of platinum to the representatives of France and requested the legal recognition of these standards as the basis of the new system.

This meeting was of great economic and scientific importance. Not only was France about to achieve the standardization of measures and bring order out of chaos, but the presence and approval of foreign scientists gave the new measures the universal acceptance which was the ambition of those who had promoted the metric system.

The Dutch delegate, Van Swinden, was deputed to submit the report to the Assembly. The closing words of the report were: "Lastly, we hope that this excellent metric system will be adopted by all the nations in the world."

This hope was far from being fulfilled in the next few years. In France itself, there was a tendency to cling to the old names and the old customs—a tendency inherent in the very nature of the French economy, which, in rural areas, was particularly inaccessible to outside influences. Finally, the metric system became legally compulsory in France only as from January 1, 1840.

In 1872, the International Commission for the Metre, which brought together representatives of 29 countries, laid the foundations for an international metric system and established its standards, taking as a basis the remarkable standards established for the Republican units by the masterly technicians Fortin and Lenoir.

In 1899, all the countries of Europe, except Great Britain and Russia, had adopted the system. It was instituted in Russia immediately after the Revolution of October 1917. England, which in 1789 came so near to co-operating with France in the international standardization of measures, still clings to its old units —the pound, the foot, the yard—and every scientist knows the difficulties resulting from the use of the English system in calculations.

The influence of the metric system throughout the world has promoted commercial and scientific relations between the peoples. The first systematic attempts at international scientific collaboration date from the introduction of this system. It was for the purpose of inaugurating the metric system that the first international scientific conferences were held and the first international institutions set up, such as the International Bureau of Weights and Measures, at Sèvres, which has been in operation since 1875 and whose members meet every six years, offering an excellent example of world-wide co-operation, inspired by science.

On October 14, 1960, delegates from 32 countries attending the 11th Conference on Weights and Measures in Paris, enthusiastically and unanimously adopted a new definition of the metre corresponding more closely to scientific needs.

According to this new "natural and indestructable" standard, the metre is defined as the length equal to 1,650,763.73 times the wavelength in vacuo of the orange emission line of the element Krypton 86.

The history of the establishment of the metric system brings out clearly the constant and fruitful interaction which takes place between science and technology.

The introduction of the metric system by the revolutionary Assemblies, and in particular by the Convention shows how scientific knowledge became part of the life and the economy of society. It is also the first example of scientific rationalization by society itself.

LUCE LANGEVIN, *agrégée de l'Université (Physics), is an honorary member of the staff of the Lycée Fénelon, Paris, and now lecturer in science at the Université Nouvelle in Paris.* *This article is an abridged version of a study published in Unesco's quarterly "Impact of Science on Society", Vol. XI* (1961) *No. 2.*

One of the world's great civilizations, the Mayan, vanished from pre-Columbian Central America in the 10th century A.D. When the Conquistadores arrived 600 years later they saw only a few vestiges and ruins of their glorious past. Amazing architects and artists, the Mayas built numerous cities throughout their empire, some of which are still being uncovered from the tangle of jungle which has hidden then for centuries. The unique character of Maya art comes from the treatment of the serpent which has left its mark on all the civilizations of Central America and southern Mexico. Above, copy of a relief found at Chichen Itza, Yucatan (Mexico) representing the famous "Plumed Serpent" with human head. Below, a small temple at Pelenque, in Mexico.

© Charles Lenard, Nice

Soviet mathematicians have succeeded in deciphering the hieroglyphic script of the ancient Mayas of Mexico and Central America with the help of modern electronic computing machines. Last year at a session of the All-Union Mathematical Congress, historians and linguists and hundreds of other people packed the assembly hall of the Leningrad Mining Institute to hear a famous Soviet mathematician, S.L. Sobolev, announce the deciphering achievment in a special paper. Dr. Sobolev is Director of the Soviet Institute of Mathematics, Siberian Division, of the Academy of Sciences of the U.S.S.R., who was in charge of the work on the Maya manuscripts. The article below tells the fascinating story of the Maya manuscripts, why electronic computers were used, and how the deciphering was done.

WHEN Europeans first reached Central America they discovered on the Yucatan Peninsula the highly-developed civilization of the Mayas. The Mayas had built awe-inspiring cities and possessed their own system of writing. Actually it was the only system of writing ever invented by any of the aboriginal inhabitants of America. The Maya priests possessed astronomical observatories very much like those of Ulugh Beg in Central Asia, the huge stone edifices of which were designed for the study of the sky with the naked eye. (1) The calendar constructed by the Maya priests was, despite its intricacy, more accurate than our present Gregorian calendar. How many centuries' observation must have gone into the production of such a calendar!

The Europeans, however, showed no interest in the Maya calendar; the Conquistadores destroyed the Maya state and burned the Maya books; Maya idolatry was replaced by Christianity, Mayan young men were sent to Catholic schools, and in a very short time the secret of the Maya system of writing was forgotten, no one could read the old manuscripts and, indeed, very few of them were left to read.

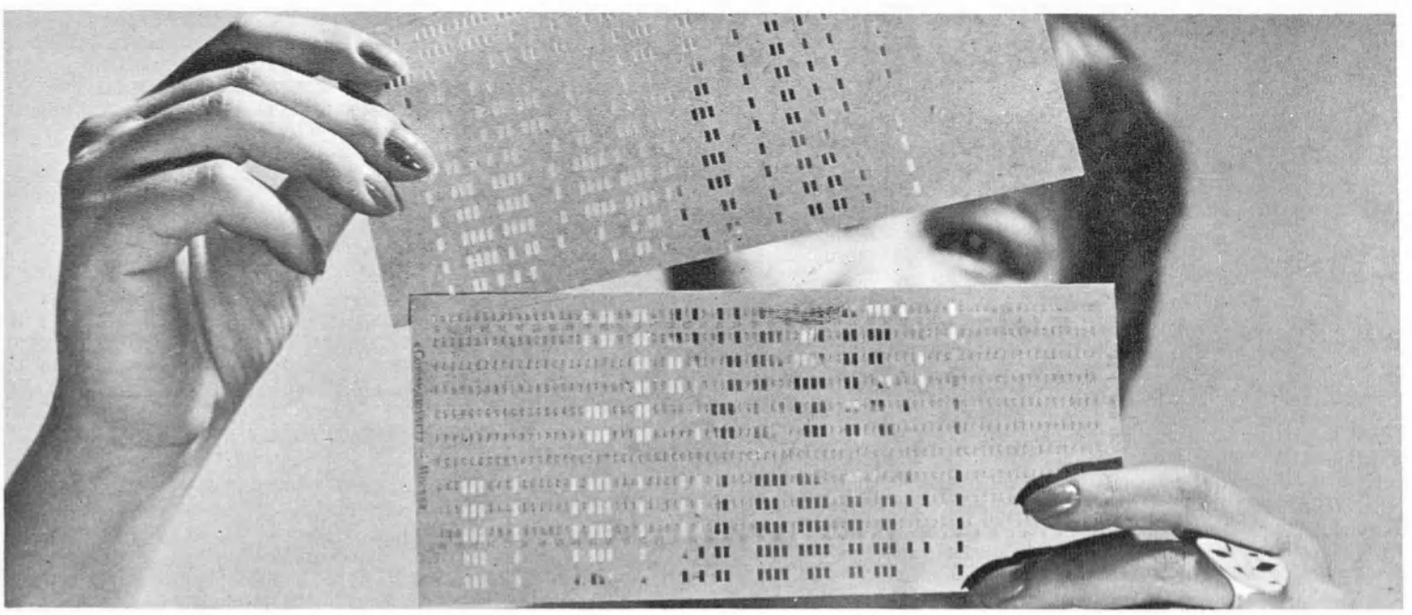
(1) *Ulugh Beg* (1394-1449) *a grandson of Tamerlane, founded about* 1420 *a splendid observatory at Samarkand. Under his patronage astronomical tables were drawn up which constitute one of the great legacies in astronomy that the East has bequeathed to the West.*

Cryptogram technique used to solve linguistic enigma

COMPUTER DECIPHERS MAYA HIEROGLYPHS

by Felix Shirokov

Lecturer, Moscow Power Institute



Novosibirsk Institute of Mathematics, U.S.S.R.

Soviet scientists using cryptogram-deciphering techniques and modern electronic computers have cracked the Mayan script. Photo shows two perforated cards used in the operations. Computers took only 40 hours to do the job for which the human brain would have needed thousands of years.

Only three manuscripts have been preserved; they are now in museums in Madrid, Dresden and Paris. The Paris codex was in a bad state from the time of its acquisition and the Dresden codex was badly damaged during the Second World War and may be considered as non-existent; fortunately this manuscript had been published and research workers are able to use a printed copy. There are also a number of inscriptions on stone, done in a special "lapidary" script. These, taken together, constitute the sources of our knowledge of the Maya *system of writing*.

The *language* of the Mayas, on the contrary, is well known. There exist two Maya-Spanish dictionaries—the Motul and one compiled by Brasseur de Bourbourg. The Maya words in these dictionaries (there are about 10,000 in the Motul) are transcribed in accordance with the old Spanish spelling.

There are also some texts in the Maya language, such as the Chilam Balam books of chronicles and prophecies written by Maya priests using the same Spanish alphabet. The scribes had not much idea of how to break up phrases into their constituent words and the Chilam Balam books contain some very lengthy word-monsters. Furthermore, since the sounds of the Maya language were different from those of Spanish, the scribes used combinations of letters for each sound. It is not known, however, exactly what sounds these letter combinations were intended to represent.

The Chilam Balam books are based partly on original Maya documents and describe events that took place at the time of the colonization of the country. Lastly, there are about a million people in Guatemala and Honduras who speak a Maya language that differs very considerably from that spoken four hundred years ago owing to the changes that have taken place since the Spanish conquest.

Diego de Landa, second Archbishop of Yucatan, compiled a book entitled *Report on the Affairs of Yucatan* (1566). He believed the Maya symbols to be the letters of an alphabet and reproduced them as such in his book. Scholars have since tried to read the Maya manuscripts by using de Landa's alphabet but have always been unsuccessful. The "alphabet" actually bore little resemblance to the symbols in the manuscripts and, furthermore, it has been shown that the Maya system of writing is not alphabetic.

Many years devoted to deciphering the Maya writings have produced some results; symbols indicating dates have been identified, individual words have been read, and, finally, a Leningrad scholar Y. V. Knorozov, has succeeded in reading whole phrases; Knorozov proved that the Maya script is hieroglyphic and that the symbols may

CONT'D ON NEXT PAGE

A gigantic crossword puzzle

represent a sound, a syllable or a whole concept (ideogram).

Such was the situation when three young scholars of the Institute of Mathematics, Siberian Division of the Academy of Sciences, tackled it; the three mathematicians were E. V. Yevreinov, Y. G. Kossarev and V. A. Ustinov, all working at the Novosibirsk Institute of Mathematics.

On the one hand there were the hieroglyphic manuscripts (the mathematicians used the Madrid and Dresden MSS) in which each character might depict any one of the "elements" of the language—a sound, a syllable or a word. On the other hand there were the Chilam Balam books and the dictionaries from which the elements of the language were known. The hieroglyphic symbols had to be correlated with these language elements and for this a process of mathematical substitution was necessary; in other words, for the manuscripts to be readable the symbols had to be replaced by the language elements they represented. There are altogether some 400 hieroglyphs in the manuscripts, about a half of which had not been identified when the mathematicians began their work.

Such a substitution is not difficult in principle. All you have to do is to sit down and try out all possible substitutions in all possible combinations until you strike the correct one. Unfortunately this is impossible in practice because the number of possible substitutions is such that all the people on earth, all those living in the past, the present and the future, would never complete the task. And to find the solution by guesswork would be as improbable as getting an ape armed with a typewriter to write *Alice in Wonderland.*

This is where the electronic calculator, the modern, rapidly functioning computing machine come into the picture. This electronic secretary was given the job of solving a unique crossword puzzle that contained several thousand words in an ancient language. But before the solution could be found the appropriate data had to be fed into the machine.

The Maya manuscripts were the work of different scribes living at different times and the hieroglyphs looked different when drawn by a different hand. The first thing, then, was to identify individual hieroglyphs. In this the Novosibirsk group received considerable help from Y. V. Knorozov.

The scholars adopted an entirely new principle; instead of trying to discover the meaning of separate symbols they tackled the text as a whole. The statistical method, the basic method used by the Novosibirsk scholars, can be applied only to a complete text. Furthermore, the correctness of the "substitution" would be guaranteed only when a text was readable and understandable as a whole and in connexion with drawings accompanying it.

The entire mass of words constituting the Maya language was arranged in a number of sequences that would enable any word to be found from any of the letters it contained, initial, medial or final; this is actually what we do when we are solving a crossword puzzle—when some of the letters of a word are known we fill in the others according to those already in the squares.

The Motul dictionary and the entire Chilam Balam text (about 60,000 words) and the symbols for calendar dates were also arranged in order and codified; Maya-Russian glossaries were compiled for such subjects as the animal and vegetable kingdoms, crafts, deities (with ritual, sacrifices, etc.), astronomical and chronological terminology and, lastly, the words most frequently occurring.

It was possible to hazard a guess at the contents of the Maya manuscripts from the drawings on them and the thematic glossaries helped the search for the necessary words. All this mass of material was recorded on perforated cards and magnetic drums, the computing machine's auxiliary memory. The hieroglyphic characters were then analyzed in the same way. Finally, the drawings in the manuscript were broken down into elements and codified. The whole material thus obtained was then processed statistically.

You will remember how in Poe's story, *The Gold Bug,* William Legrand found his gold bug wrapped in a piece of parchment on which was written a cryptogram compiled by William Kidd the buccaneer. It began.

53 ‡ ‡ + 305))6*; 4826)4 ‡ .)4 ‡)

You will also remember that Legrand counted the number of times each symbol occurred in the cryptogram and arranged them in descending order of frequency.

Legrand assumed that Captain Kidd would not be capable of compiling a complicated cryptogram, and therefore decided, that each symbol in the cryptogram would represent a letter of the English alphabet. Legrand knew that the letter "e" occurs more frequently than any

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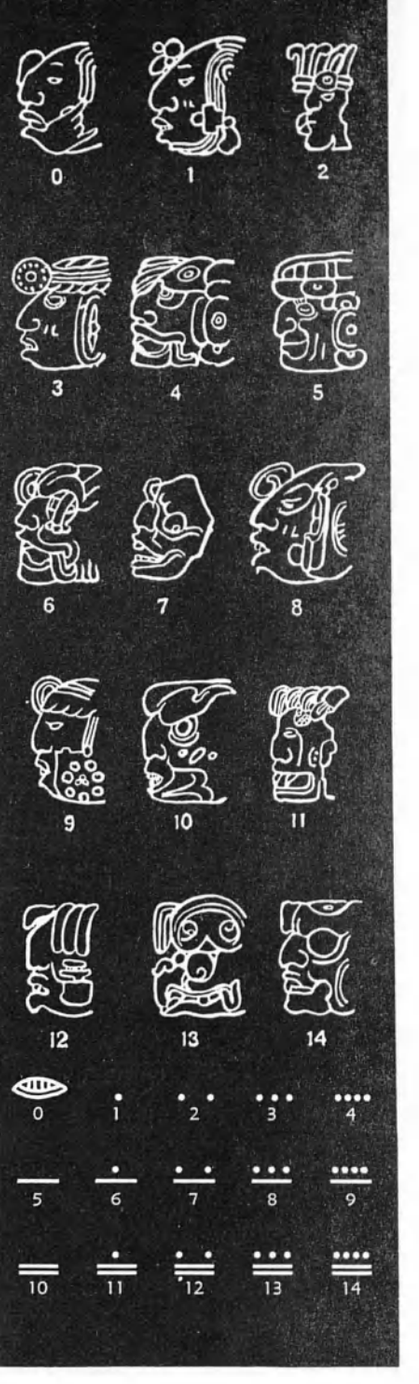
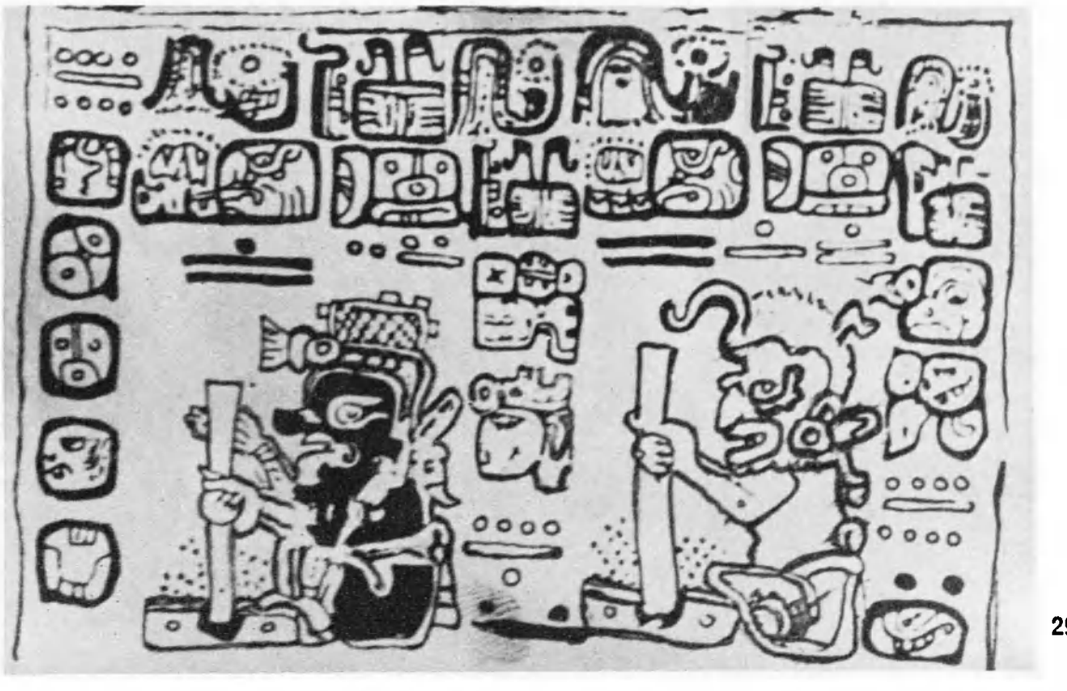


Photos Novosibirsk Institute of Mathematics

PEOPLE OF THE CALENDAR

Soviet scientists E. Yevreinov, Y. Kossarov and V. Ustinov compare Maya manuscripts with the deciphering results obtained by their computer. Manuscripts were found to be priestly books. Fragment, right, describes how the gods of good and evil made their fires. Left, a fragment from a Maya priestly calendar indicating when the maize god, the god of death and other gods fired pottery. The Mayas were amazing astronomers and mathematicians and produced the most precise calendar known to this day. Scholars have long known that the Maya monuments do not contain a single ornament, relief or frieze that is not connected with some date. There is no other case in the world of such subordination of architecture to the calendar. The Mayas used not one but two types of notation for their numbers. These systems were deciphered many years ago. Shown above right are: glyphs with varying human heads and bar-and-dot numerals



MAYAS VISIT THEIR ANCESTORS

Since the middle of the 19th century archaeologists have been uncovering the remains of Maya cities in the tropical forests of Guatemala, El Salvador, Honduras and Mexico. The descendants of the Mayas still speak dialects resembling the language of their ancestors. Here, an Indian family visits a museum in Guatemala City where many of these treasures made by their forebears — reliefs, sculpture and stelae — are preserved. Whether the sudden collapse and disappearence of the remarkable Maya civilization was caused by wars, destructive epidemics or a natural disaster of some kind is still a complete mystery.

Photos © P. Almasy

From Poe's gold bug to the seven of diamonds

other in the English language and is followed in descending order of frequency by a, o, i, d, h, n... This gave him the clue.

The symbol "8" was the most frequent in the cryptogram and Legrand therefore identified it as the letter "e". Then he guessed the definite article "the" and so on, filling in the missing letters on the basis of those already identified until he had the whole message: "A good glass in the bishop's hostel in the devil's seat forty-one degrees and thirteen minutes..."

The Maya priests were probably no more efficient as "cipher clerks" than the bold Captain Kidd and it was assumed that their hieroglyphic "cryptograms" were compiled by the same method. The Novosibirsk mathematicians therefore decided to try and solve them by the "Edgar Allan Poe" method.

In any language, be it Russian, Spanish or Maya, every language element (sound, letter, syllable, etc.) occurs with a frequency typical for the given language. An English text written in a phonetic alphabet, say that of Bernard Shaw, would be easy to decipher. It would only be necessary to find the frequency of occurrence of all the symbols used and compare it with the known frequency of English sounds.

THE Novosibirsk mathematicians used their electronic computer to find the frequency of letter combinations in the Maya language as revealed by the Chilam Balam books. Then the computer found the frequency of occurrence of the hieroglyphs in the Madrid and Dresden manuscripts. After that, there remained only the job of correlating the frequencies. But here they came up against a snag.

Let us imagine that Captain Kidd, instead of terrorizing the Caribbean on his buccaneering trips, took a devoted interest in entomology. Any tiny insect would then have had greater significance for him than the sordid yellow metal. He might even have written a *Treatise on Gnats* and enciphered it. The combination of letters "gn," which is not typical for English, would have occurred very frequently in the cryptogram and would have upset William Legrand's statistical picture. even if Legrand himself had been profoundly interested in insects; the "gnat effect" would have provided greater difficulty for him.

The Novosibirsk scholars came up against a similar "gnat effect" in their work; the hieroglyphic manuscripts and the Chilam Balam books belong to different epochs and deal with different subjects.

The simplest hypothesis was that one hieroglyph represented a pair of letters in the Maya language (had each character represented a letter the script would have been alphabetic). This was the working hypothesis adopted by the mathematicians. The frequency of occurrence of the hieroglyphs and that of the pairs of letters, however, simply refused to coincide—the symbols could not be directly identified with the letter pairs. Could their working hypothesis possible be wrong? No! the cause of the trouble was the specific nature of the texts. Let us try to show by an example what the mathematicians had to do.

LET us take a pack of 52 playing cards and arrange it by suits in the order spades, clubs, diamonds, hearts, with the cards in each suit proper sequence from ace to king. This we shall call the "normal" order of the cards. Then let us shuffle each suit separately and replace the cards with the suits in the same order. The pack will now be arranged in a "special" order that will not differ very greatly from the "normal" order. The cards have been shuffled by suits, that is, within a relatively small group of cards; we may guarantee that the seven of diamonds (card 33 in the "normal" sequence) will not be in the first place but will lie somewhere between the twenty-seventh and thirty-ninth card.

In a specific text (as opposed to a "normal" one) there is also a shuffling of letter combinations that disturbs the normal order of frequencies. But, as we saw from the playing card example, the displacement is within fairly small limits. The frequency of a pair of letters does not change very greatly. Even in the *Treatise on Gnats* the "gn" pair would not occupy first place in the frequency list (diamond cards remain within the range of the diamond suit).

The mathematicians took advantage of this fact and, instead of comparing individual characters with the

CONT'D ON NEXT PAGE

Easter Island writing future target

individual pairs of letters, began to compare groups of each. To be more precise they found which hieroglyphs occur most frequently, the overall frequency of the first two most frequent, the overall frequency of the first three, and so on. They then did the same for the pairs of letters.

In this case they found a marvelous coincidence. The frequencies of the letter combinations in the Chilam Balam texts almost completely coincided with the frequencies of the hieroglyphic symbols. Half the words in the Chilam Balam texts (frequency—50 per cent) began with one of seventy pairs of letters, and half the hieroglyphic groups in the Madrid and Dresden manuscripts began with one of seventy-three hieroglyphs. According to the working hypothesis the meanings of the seventy-three symbols should be found among the seventy letter combinations.

The same work was done for other groups in the Chilam Balam texts and the hieroglyphic manuscripts, for instance, for the final pairs of letters, the computer being used for all these operations.

In this way, step by step, identifying and comparing, using the computer to analyze the thematic glossaries and calculate frequencies, the three Novosibirsk mathematicians deciphered the Madrid and Dresden manuscripts in full. They employed only forty hours of the computer's working time and even of that forty hours a considerable amount of time was used up in setting the machine to programmes of work.

Thus the key to one of the greatest puzzles in world history was found.

The scholars are now preparing a three-volume report on their work. The first volume will contain the Madrid and Dresden manuscripts with an alphabetical transliteration in the Maya language and translations into Spanish and Russian. The second volume will contain a complete catalogue of the symbols and the third, the programmes for the computer and the results of the mathematical analysis.

The manuscripts proved to be priests' books of auguries, prophecies, etc. To the left there are dates from the Maya 260-day cycle (the Maya "year" contained thirteen months and the "month" twenty days which gives a cycle of 260 days).

This differed from another Mayan calendar, a true calendrical year of 365 days, admirably calculated by the Mayas and divided into 18 months each of 20 days and a supplementary five-day month. For each day of the sacred calendar there is a description of the activities of the deities—the gods fire pottery, make idols, decorate temples, tend bees and crops (in other words they engage in the same activities as the Mayas themselves). The Mayas, following the recommendation of the priestly books, planted trees, fired pottery, etc., at propitious times.

The extensive Maya pantheon contained good and evil beings. There were the gods of the winds—black, yellow, white and red; the Lord of the Skulls and the young maize god (maize was the chief Maya crop); the kindly god of the North Star and the malevolent yellow jaguar. There was even a goddess allotted to people who had been hanged, for the Maya people believed that beyond the grave there existed a special paradise for these unfortunates...

Here are some examples from the translation:

The young maize god fires pottery from white clay;
The god of death, the destroyer, fires a pot;
The god of the North Star fires a pot;
The yellow jaguar fires a pot.

There are some phrases that sound very modern, although the Mayas no doubt put a different meaning into them; the legend to one of the drawings reads: "The woman's burden is the god of war."

The work on these manuscripts has been completed but there are other systems of writing that have not yet been deciphered. A special group of philologists in Novosibirsk contemplates working on the Rongo-Rongo inscriptions from Easter Island.

The use of mathematical methods and computing machines in the most diverse fields of science and culture is typical of our age. This amazing piece of work on the Maya manuscripts is only the beginning of the application of mathematics to the study of linguistics and history.

THE UNESCO PHILATELIC SERVICE

On this page we present stamps recently issued to honour Unesco and its work. Right, six stamps from Ecuador mark setting up with help from Unesco of a marine biological research station in the Galapagos Islands. (See The Unesco Courier, September 1961). Below, stamps issued by Liberia, Viet Nam and the Republic of Korea commemorate Unesco's 15th anniversary. These stamps can be obtained from the Unesco Philatelic Service which as the agent in France of the U.N. Postal Administration, stocks all U.N. stamps and first day covers now on sale. For prices and further details write The Unesco Philatelic Service Place de Fontenoy, Paris-7e.

Letters to the Editor

TAGORE IN SWITZERLAND

Sir,

I read with great pleasure your fine issue on Rabindranath Tagore (December 1961). However, I was sorry that no mention was made of Switzerland among the reports of celebrations held around the world to mark the 100th anniversary of the poet's birth.

Switzerland had a place in the life of Tagore for it was here that he met Romain Rolland in 1926 (he had already visited Switzerland in 1921 and spoken in Geneva and Basel) and our country thus had a reason to join in celebrating the centenary. A Tagore exhibition was held in May 1961 at the National Library in Berne, homage to him was paid by Swiss radio stations and many articles appeared in the press.

We owed it to ourselves to commemorate the centenary of this great citizen of the world and we did so, perhaps more modestly than other countries, but with equal fervour.

Eric Descœudres
Editor in Chief
"Coopération," Basel

SOUTH AFRICA & THE BANTU

Sir,

I have seen many articles on what is being done for education in the North African Black States but have looked in vain for any article or photographs on what is being done in the Republic of South Africa for the native Bantu. Separate development is condemned in almost every country in Europe and of course by the Afro-Asian block, without any one of them taking the least trouble to find out the real state of affairs here. Is it not your duty to enlighten them and so establish a better relationship between the South African Republic and the rest of the world?

It is the money of the white taxpayer of the Republic which has been, and is being used in the building of hospitals, churches, schools, universities, houses, and recreational centres for the Bantu population, and now has given them their own homelands.

There is a constant stream of foreign natives into the Republic because of better living conditions and higher wages than in the neighbouring states.

D. A. Jooste
Potchefstroom, S. Africa

TWO CITIES WITH A TALE

Sir,

The story of the rebirth of Warsaw which appeared in the Japanese edition (May 1961) of The Unesco Courier was most interesting.

I am a citizen of Hiroshima which, as is well known, was the first city to be attacked by a nuclear weapon in the last war. I was much impressed by the pictures in your magazine which compared Warsaw of 1945 with that of 1961. Hiroshima too has recovered remarkably since the war. I hope the world will learn how the atom-stricken people have rebuilt their city and how they enjoy their peaceful life now. The same thing may be said of the other old Japanese city of Nagasaki whose people also experienced the atomic tragedy. I wish THE UNESCO COURIER would take up the story of the two Japanese cities.

Go Kawaguchi
Hiroshima City, Japan

FROM NORTH OF THE BORDER

Sir,

Your article about Fridtjof Nansen (November 1961) is prefaced by the words "a man must and shall be valiant, he must march forward and quit himself like a man."—Thomas Carlyle. Carlyle was born in a village near Dumfries in Scotland, called Ecclefechan. He was a Scot and not English as stated in the article. After all, Nansen proudly remembered and celebrated his nationality in the wastes of the Arctic.

Gordon Murray
Glasgow, Scotland

THE PICASSO DEBATE

Sir,

Under the title of "Letters to the Editor" in the last months I could view unfolding a "silent" debate about Picasso's art. These letters urge me to raise a question for the ardent defenders and opponents of this critical art: Is there an art Picasso's at all? It is abacking and astonishing of course. But this feeling of astonishing in the spectators is it equal to the artistic effect? I can't believe so.

What does Picasso want to express to man—I think every artist wants to say something for the spectators, the world in general and in special, with the characteristic language of his own art—by these sometimes formules, deformed or distorted figures ?

Has Picasso visions? Maybe he is suffering from some soul-sickness—in this case I can understrand. One who is suffering from serious soul or nerve disease used to see the spherical forms as angulars, the whites as blacks and so on. If it were so I could understand, but the ardent followers of the Picasso's line are protesting against this.

Maybe there is a tendency to relapse the spiritual claim of grown-up men into the level of 3-4-year-old children? The writer of this letter has 3 and 4-year-old children of his own also and the creations of these young men remind me of some of Picasso's pictures— excuse me, the great artist! Against this are protesting the faithful defenders of this "art."

Maybe Picasso's pictures and figures are a glove into the face of little bourgeoisie and snobs? But *hélas!* What makes these nightmare matters artistic creations? There is a debate about this problem a couple of decades already, but nobody could say the truth... I should like to have an answer besides "Mme. Camelin likes" or "Mr. Cherkosova dislikes" Picasso.

Dr. Alexander Hegedüs
Pecs, Hungary

A PLEA FOR SURVIVAL

Sir,

It has become almost laughable for us to express our horror at the insane manœuvres of our various heads of government—in seeing these directed towards an almost inevitable mass suicide. Many have gathered to protest...but their pleas have remained inarticulate, for those to whom they were addressed paid them no heed. Aggressive policies continue.

Perhaps, as long as there are national orientations, each government within its own specific rationale is helpless to do otherwise. To them the problem appears to be a choice between Eastern and Western systems, and fear, distrust and, ultimately, hatred are the consequences. Nevertheless the people whom these governments are supposed to represent see it as a problem primarily, and most urgently, of survival.

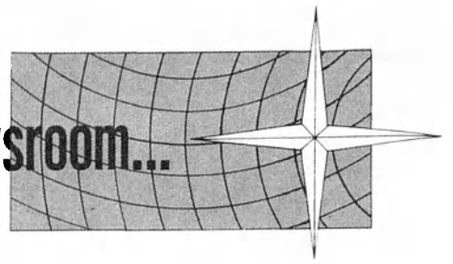
They have not the vested interests that would make intelligible to them endless, meaningless hitches to agreements among leaders. Thus what they see is the insanity of a threat to human existence for the sake of ends they don't understand and benefits in which they have no share. And there is small consolation in knowing that they are being killed by their own radio-active fallout and not that of the "opposite" side.

It seems pointless addressing ourselves to or through our governments. There remains only one way of making ourselves effectively heard, and that is by affirming our friendship for all people who, similarly, have remained politically mute but whose plea, as ours, is for survival in a hateless, radiation-less world.

We address ourselves directly to you.

Veronica and Brian Maltby
Sydney, Australia

From the Unesco Newsroom...



BRAZIL'S 'CHILDREN'S CITY': About 150 miles from Brasilia, the new capital of Brazil, another town is being built which will provide a home for 22,000 homeless boys and girls—orphans ranging in age from one to seventeen years. They will be grouped in "families" of six children in separate homes and under the care of a married couple. Covering a site of over 1,700 acres, the Children's City will have schools and training colleges of all kinds, and also museums, theatres and libraries.

■ **ARTS AND CRAFTS TRAIN:** Two bright blue railroad coaches carrying an unusual load recently set off on a year-long trip around the U.S. State of Kentucky. One coach contains exhibits of arts and crafts from all over the U.S.A.—paintings and sculptures, hand-woven textiles, pottery and ceramics, silkscreen work, etchings, and examples of wood and metal work. In the second coach, visitors are invited to try their hand at woodcarving, ceramics, etc. for which tools are provided. The project was conceived by the Museum of Louisville, Kentucky and has been supported by other U.S. museums and organizations.

AFRICA'S EDUCATION CENTRE: A UNESCO Regional Centre for Education in Africa, which is staffed by UNESCO specialists, has been opened in Accra, Ghana. It will provide documentation and information, gathered from nearly every country in Africa, on school curricula, syllabuses, health provisions, use of recreation time, technical and vocational training, and every aspect of teacher-pupil relationships. A special textbook unit will assist African authors and publishers in preparing and producing new textbooks and teaching materials. The operation of the Accra Centre is part of UNESCO's emergency programme for the development of education in Africa which has a $4 million target figure.

■ **ELECTRICITY FROM THE SEA:** Soviet engineers plan to produce electricity by using the action of tides in the Barents Sea. The power station they are to build will be an experimental one with a capacity of 1,200 kws, located at Kisleguba, northwest of Murmansk. Tide levels in the Barents Sea can have differences of up to 35 ft. In slack periods turbines will be kept working by water from a reservoir.

THEY HAVE IT TAPED: "Friendship Tapes" recorded by schoolchildren of the Province of Saskatchewan, in Canada, present music and folksongs and informal chats about the sights, sounds and activities of children's life in that western Province. These are then exchanged with tapes made by children in schools in regions ranging from the Pacific, to Europe and Asia. In this way children can compare notes about such things as Christmas celebrations in such widely differing places as sunny Australia and snowbound Saskatchewan.

■ **103 MEMBER STATES:** Unesco has now 103 member states, the latest to join being the Islamic Republic of Mauritania. Two other countries—Cyprus and Ireland—became UNESCO member states in 1961, and on October 25 the Syrian Arab Republic which had originally joined in November 1946, resumed its place as an individual member state.

'MY FAIR LADY' & THE BRITISH MUSEUM: Strange as it may seem, the success of the musical comedy, "My Fair Lady" directly interests the British Museum. This Museum as well as the Royal Academy of Dramatic Art in London and the National Gallery of Ireland are the chief beneficiaries of the estate of the late Bernard Shaw. For the past three years each of these institutions has received about £ 260,000 chiefly provided by the royalties from "My Fair Lady," the musical adaptation of "Pygmalion".

■ **ONE-FIFTH OF MEXICO'S BUDGET FOR EDUCATION:** Mexico will spend, 2,400 million pesos ($ 200,000,000) on education this year This sum represents 20 % of the national budget and is the highest which the country has ever alloted to education. The main aim is to keep education in step with the country's economic development.

NEW ROLE FOR THE WOMEN OF PAKISTAN: Women are to serve as members of Pakistan's Legislative Assembly. This decision, taken under the country's new constitution, was announced by General Mohammed Ayub Khan, President of Pakistan, when he inaugurated a recent conference in Karachi on the role of women in national economic development.

■ **GABON'S SCHOOL RECORD:** The Republic of Gabon can now boast Africa's highest percentage of school-age children actually in the classroom—a total of 80 %. One hundred and forty new schools or classrooms have been opened, bringing the number of schools to 470 with 1,400 classrooms accomodating 60,000 pupils.

TRAFFIC LIGHTS THAT 'THINK': Automatic traffic lights which regulate the flow of vehicles electronically have been installed in Leningrad. For a continuous stream of traffic the "thinking" lights change every 50 seconds, but when there is no traffic in one direction, the lights remain green for cars approaching from another. The electronic device controlling the lights is able to decide which vehicle has priority and which should stop, and can also count cars passing through the crossroads.

■ **A PUPPET ODYSSEY:** Two young Frenchmen, Philippe Genty and Serge George, have left Paris by car on a round-the-world trip of an unusual kind. With their three puppets Alexander, William and Zizi, they are carrying out an enquiry into the art of puppetry in 36 countries on four continents.

UNIVERSITIES OF S.E.ASIA: A study of the role of universities in the development of countries in South-East Asia is to be made by UNESCO and the International Association of Universities with financial aid from the Ford Foundation. The study will be carried out in Burma, Cambodia, Indonesia, Laos, Malaya, the Philippines, Singapore, Thailand and Viet Nam.

■ **WORLD FILM DIRECTORY:** UNESCO has been preparing for publication an international directory listing agencies and organizations concerned with educational, scientific and cultural films throughout the world. A first edition in five separate geographical sections was published in 1952-52 and this is now being brought up to date and supplemented.

UNESCO TO CARRY OUT PROJECTS FOR U. N.: Nine projects in education and scientific research, amounting to $8,065,000, have been approved by the Governing Council of the United Nations Special Fund with UNESCO as their executing agency. These are to be carried out in Japan, Mali, Nigeria, Pakistan, the Republic of the Congo (Brazzaville), Senegal, Tunisia, Uganda and Venezuela. Governments of these countries will more than match international aid in their own contributions which will total more than $21 million. Fields covered in the projects include earthquake engineering, training of teachers and engineers and research on use of saline water in irrigation.

■ **GIANT GROWTH OF RADIO & TV:** In the past 13 years—since the United Nations General Assembly adopted the Universal Declaration of Human Rights, including the right to knowledge and information—radio and TV have made giant strides. The number of radio transmitters has increased from 5,450 to 11,670 and receivers from 161 million to 366 million. The number of countries operating regular TV programmes grew from 4 to 65 in the same period, and there are now 100 million television receivers compared with four million in 1948.

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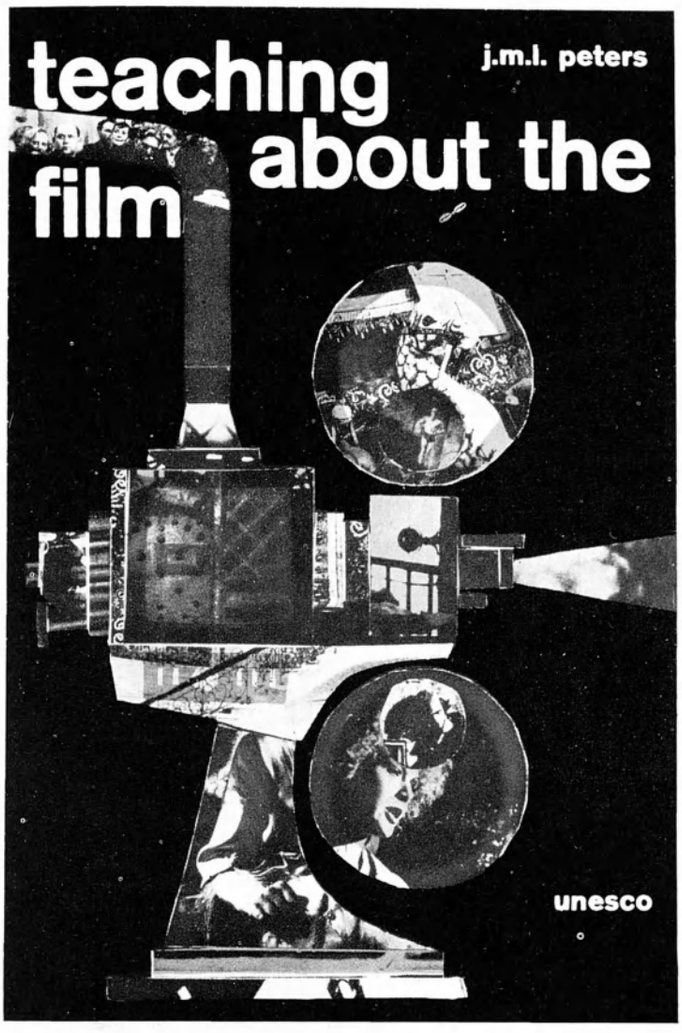

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120 p., 28 pages of illustrations.

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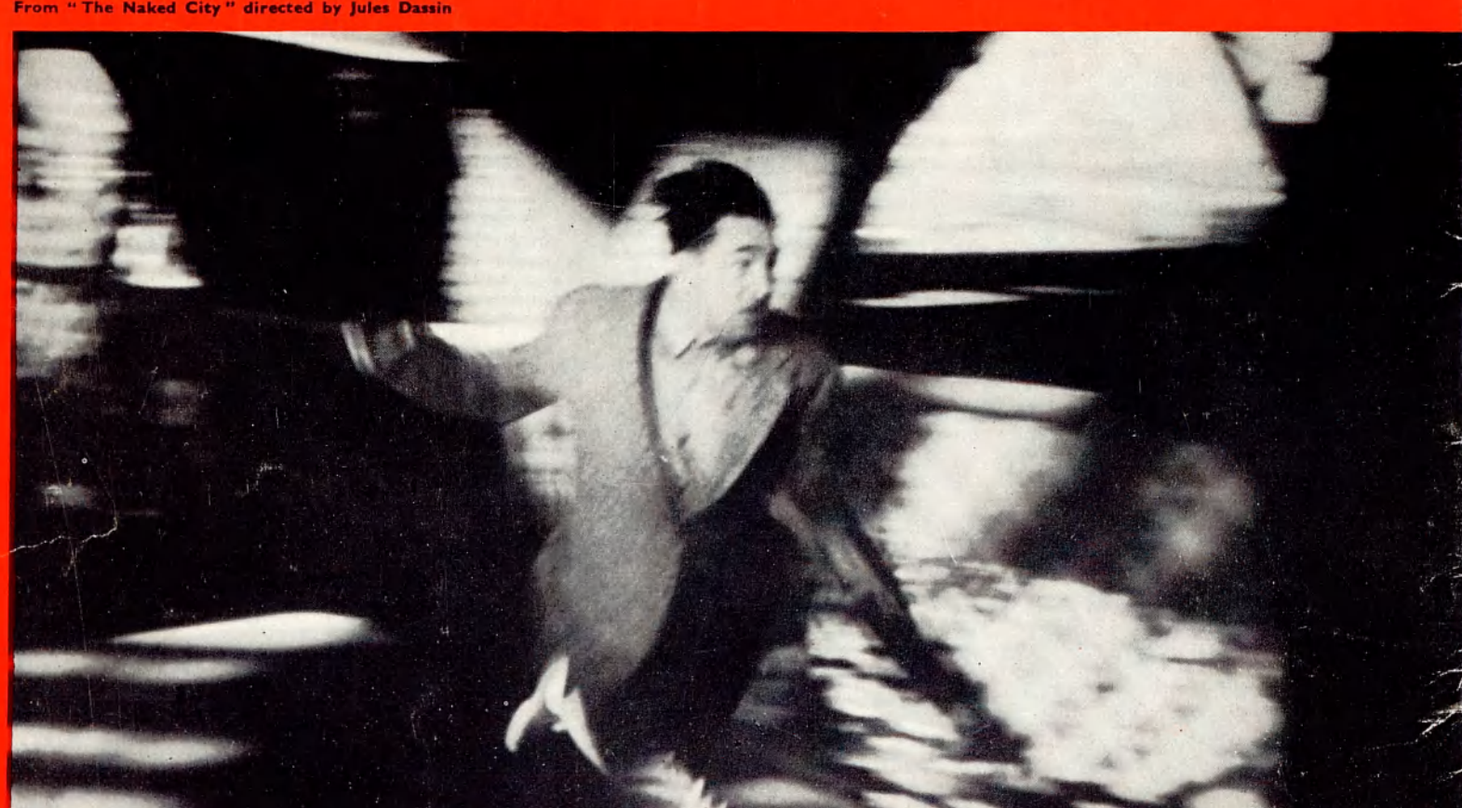
THE CINEMA...

...ARE WE 'OUT OF FOCUS'?

From "Ultimo Incontro", directed by Gianni Franciolini

The cinema has a tremendous emotional impact on young audiences everywhere. The fascination of superproductions, the excessive admiration for film stars and the myth built up about the screen "idol" all are contributing to the uncritical surrender of young people to films. How can these young people learn to be more discriminating about the films they go to see, and how can they learn to look at a picture with discernment and enough detachment to avoid becoming so emotionally involved that it warps their outlook? The story published on page 4 offers some answers.

From "The Naked City" directed by Jules Dassin